ATTACHMENT 1
to FCC Public Notice DA 10-2060

Recommendations presented at 26 October 2010 Meeting of the Advisory Committee for the 2012 World Radiocommunication Conference

Maritime Aeronautical and Radar Services

DOCUMENT WAC/094(26.10.10)

UNITED STATES OF AMERICA

Draft Proposals for the Work of the conference

Agenda Item 1.3: *To consider spectrum requirements and possible regulatory actions, including allocations, in order to support the safe operation of unmanned aircraft systems (UAS), based on the results of ITU-R studies, in accordance with Resolution* ***421 (WRC-07)***

Background Information: Unmanned aircraft systems (UASs) enable the remote piloting of aircraft over short or long range distances within or out-of-sight of the remote pilot. These flight operations currently take place in segregated airspace to ensure the safety of the air vehicle and other airspace users.

Some administrations expect deployment of UASs throughout the airspace structure, i.e. within both segregated and non-segregated airspace. As UAS deployment increases, it will be impractical for some users to deploy in segregated airspace. Some UASs will need to integrate with the current non-segregated airspace users in a safe and seamless manner. To accomplish integration into non-segregated airspace, UASs will require high integrity communication links between the unmanned aircraft (UA) and remote control centers capable of relaying the necessary air traffic control (ATC) messages and flight critical aircraft information. The UAS pilot will need sense and avoid functions for situational awareness.

The International Civil Aviation Organization (ICAO) future communications study may be able to identify technologies with some capability to meet the requirements for command and control, including the relaying of ATC communications. The ITU-R is currently examining existing aeronautical allocations to satisfy UAS spectrum requirements prior to studying new allocations. Additionally, the ITU-R is investigating the addition of a new AMS(R)S allocations within portions of the 22.50 – 22.55 GHz or 23.55-23.60 GHz bands to satisfy the UAS beyond line-of-sight communication requirements. However, sharing studies need to be conducted to ascertain whether these bands can be allocated to the AMS(R)S.

***Command & Co*ntrol**

In non-segregated airspace, the remote pilot must reliably monitor the status of the UA, pass control instructions to the UA, and interact with the appropriate air traffic controllers monitoring the airspace within which the UA is flying. A line-of-sight link might provide these capabilities for UA flying and maneuvering in a localized area. A combination of a terrestrial radio and satellite network could provide these capabilities to UA flying trans-horizon.

Relay of Air Traffic Control (ATC) Communications

Safe operation of manned or unmanned aircraft depends on ATC communications. Pilots act based on ATC instructions. When the aircraft is piloted remotely, the pilot and ATC must maintain a communication channel to relay information from a radio in the aircraft to the pilot on the ground. Early concepts assume that this function, if digitized, could be part of the command and control links.

Sense and Avoid

The safe flight operation of UA necessitates advanced techniques to detect and track nearby aircraft, terrain, and obstacles to navigation. Unmanned aircraft must avoid these objects in a manner equivalent to that of a manned aircraft. The remote pilot will need to be aware of the environment within which the aircraft is operating, be able to identify the potential threats to the continued safe operation of the aircraft, and take the appropriate action. The radiodetermination service allocations could potentially accommodate the sense and avoid function. The ITU-R is examining existing aeronautical radionavigation service (ARNS) allocations for suitable bandwidth prior to studying new ARNS allocations. The UAS industry is studying the suitability of various technologies for sense and avoid.

Payload

Resolution **421 (WRC-07)** *Resolves 1* specifically excludes the allocation of spectrum at WRC-11 for payload applications. However, *invites ITU-R 3* does call for the development of an ITU-R report or recommendation on how to accommodate the radiocommunication requirements for UAS payloads. The purpose of this agenda item is not to seek new spectrum allocations to meet payload requirements.

UAS control link communication could potentially be accommodated by the FSS through the use of portions of the existing 11/12/14 GHz and 20/30 GHz FSS allocations. Specifically through the addition of an appropriate footnote to the Table of Frequency Allocations that would in turn incorporate by reference a WRC-12 Resolution which would contain the necessary technical and regulatory provisions for support of a UAS type of service. The use of the aforementioned FSS bands can contribute to satisfying the UAS beyond line-of-sight communications requirements.

Proposal*:

MOD USA/1.3/1

ARTICLE 5

Frequency Allocations
10-11.7 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
10-10.45 FIXED MOBILE RADIOLOCATION Amateur 5.479	**10-10.45** RADIOLOCATION Amateur 5.479 5.480	**10-10.45** FIXED MOBILE RADIOLOCATION Amateur 5.479
10.45-10.5	RADIOLOCATION Amateur Amateur-satellite 5.481	
10.5-10.55 FIXED MOBILE Radiolocation	**10.5-10.55** FIXED MOBILE RADIOLOCATION	
10.55-10.6	FIXED MOBILE except aeronautical mobile Radiolocation	
10.6-10.68	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) Radiolocation 5.149 5.482 5.482A	
10.68-10.7	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.483	
10.7-11.7 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 5.484A 5.YYY (Earth-to-space) 5.484 MOBILE except aeronautical mobile	**10.7-11.7** FIXED FIXED-SATELLITE (space-to-Earth) 5.441 5.484A 5.YYY MOBILE except aeronautical mobile	

11.7-14 GHz

<table>
<tr><th colspan="3">Allocation to services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td rowspan="3">11.7-12.5
FIXED
MOBILE except aeronautical mobile
BROADCASTING
BROADCASTING-SATELLITE 5.492

5.487 5.487A</td><td>11.7-12.1
FIXED 5.486
FIXED-SATELLITE (space-to-Earth) 5.484A 5.488 5.YYY
Mobile except aeronautical mobile 5.485</td><td rowspan="2">11.7-12.2
FIXED
MOBILE except aeronautical mobile
BROADCASTING
BROADCASTING-SATELLITE 5.492

5.487 5.487A</td></tr>
<tr><td>12.1-12.2
FIXED-SATELLITE (space-to-Earth) 5.484A 5.488 5.YYY
5.485 5.489</td></tr>
<tr><td rowspan="2">12.2-12.7
FIXED
MOBILE except aeronautical mobile
BROADCASTING
BROADCASTING-SATELLITE 5.492

5.487A 5.488 5.490</td><td>12.2-12.5
FIXED
FIXED-SATELLITE (space-to-Earth) 5.YYY
MOBILE except aeronautical mobile
BROADCASTING
5.484A 5.487</td></tr>
<tr><td>12.5-12.75
FIXED-SATELLITE (space-to-Earth) 5.484A 5.YYY (Earth-to-space)

5.494 5.495 5.496</td><td>12.7-12.75
FIXED
FIXED-SATELLITE (Earth-to-space)
MOBILE except aeronautical mobile</td><td>12.5-12.75
FIXED
FIXED-SATELLITE (space-to-Earth) 5.484A 5.YYY
MOBILE except aeronautical mobile
BROADCASTING-SATELLITE 5.493</td></tr>
<tr><td>12.75-13.25</td><td colspan="2">FIXED
FIXED-SATELLITE (Earth-to-space) 5.441
MOBILE
Space research (deep space) (space-to-Earth)</td></tr>
<tr><td>13.25-13.4</td><td colspan="2">EARTH EXPLORATION-SATELLITE (active)
AERONAUTICAL RADIONAVIGATION 5.497
SPACE RESEARCH (active)
5.498A 5.499</td></tr>
<tr><td>13.4-13.75</td><td colspan="2">EARTH EXPLORATION-SATELLITE (active)
RADIOLOCATION
SPACE RESEARCH 5.501A
Standard frequency and time signal-satellite (Earth-to-space)
5.499 5.500 5.501 5.501B</td></tr>
<tr><td>13.75-14</td><td colspan="2">FIXED-SATELLITE (Earth-to-space) 5.484A 5.ZZZ
RADIOLOCATION
Earth exploration-satellite
Standard frequency and time signal-satellite (Earth-to-space)
Space research
5.499 5.500 5.501 5.502 5.503</td></tr>
</table>

14-15.4 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
14-14.25	FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B 5.ZZZ RADIONAVIGATION 5.504 Mobile-satellite (Earth-to-space) 5.504B 5.504C 5.506A Space research 5.504A 5.505	
14.25-14.3	FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B 5.ZZZ RADIONAVIGATION 5.504 Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.508A Space research 5.504A 5.505 5.508	
14.3-14.4 FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B 5.ZZZ MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radionavigation-satellite 5.504A	**14.3-14.4** FIXED-SATELLITE (Earth-to-space) 5.457A 5.484A 5.506 5.506B 5.ZZZ Mobile-satellite (Earth-to-space) 5.506A Radionavigation-satellite 5.504A	**14.3-14.4** FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.484A 5.506 5.506B 5.ZZZ MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radionavigation-satellite 5.504A
14.4-14.47	FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B 5.ZZZ MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Space research (space-to-Earth) 5.504A	
14.47-14.5	FIXED FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B 5.484A 5.506 5.506B 5.ZZZ MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.504B 5.506A 5.509A Radio astronomy 5.149 5.504A	
14.5-14.8	FIXED FIXED-SATELLITE (Earth-to-space) 5.510 MOBILE Space research	
14.8-15.35	FIXED MOBILE Space research 5.339	
15.35-15.4	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.511	

15.4-18.4 GHz

<table>
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<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td>15.4-15.43</td><td colspan="2">AERONAUTICAL RADIONAVIGATION
5.511D</td></tr>
<tr><td>15.43-15.63</td><td colspan="2">FIXED-SATELLITE (Earth-to-space) 5.511A
AERONAUTICAL RADIONAVIGATION
5.511C</td></tr>
<tr><td>15.63-15.7</td><td colspan="2">AERONAUTICAL RADIONAVIGATION
5.511D</td></tr>
<tr><td>15.7-16.6</td><td colspan="2">RADIOLOCATION
5.512 5.513</td></tr>
<tr><td>16.6-17.1</td><td colspan="2">RADIOLOCATION
Space research (deep space) (Earth-to-space)
5.512 5.513</td></tr>
<tr><td>17.1-17.2</td><td colspan="2">RADIOLOCATION
5.512 5.513</td></tr>
<tr><td>17.2-17.3</td><td colspan="2">EARTH EXPLORATION-SATELLITE (active)
RADIOLOCATION
SPACE RESEARCH (active)
5.512 5.513 5.513A</td></tr>
<tr><td>17.3-17.7
FIXED-SATELLITE
(Earth-to-space) 5.516
(space-to-Earth) 5.516A 5.516B 5.YYY
Radiolocation
5.514</td><td>17.3-17.7
FIXED-SATELLITE
(Earth-to-space) 5.516
BROADCASTING-SATELLITE
Radiolocation
5.514 5.515</td><td>17.3-17.7
FIXED-SATELLITE
(Earth-to-space) 5.516
Radiolocation
5.514</td></tr>
<tr><td rowspan="2">17.7-18.1
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.YYY
(Earth-to-space) 5.516
MOBILE</td><td>17.7-17.8
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.517 5.YYY
(Earth-to-space) 5.516
BROADCASTING-SATELLITE
Mobile
5.515</td><td rowspan="2">17.7-18.1
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.YYY
(Earth-to-space) 5.516
MOBILE</td></tr>
<tr><td>17.8-18.1
FIXED
FIXED-SATELLITE
(space-to-Earth) 5.484A 5.YYY
(Earth-to-space) 5.516
MOBILE
5.519</td></tr>
<tr><td>18.1-18.4</td><td colspan="2">FIXED
FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY
(Earth-to-space) 5.520
MOBILE
5.519 5.521</td></tr>
</table>

18.4-22 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
18.4-18.6 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY MOBILE		
18.6-18.8 EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.522B 5.YYY MOBILE except aeronautical mobile Space research (passive) 5.522A 5.522C	**18.6-18.8** EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.522B 5.YYY MOBILE except aeronautical mobile SPACE RESEARCH (passive) 5.522A	**18.6-18.8** EARTH EXPLORATION-SATELLITE (passive) FIXED FIXED-SATELLITE (space-to-Earth) 5.522B 5.YYY MOBILE except aeronautical mobile Space research (passive) 5.522A
18.8-19.3 FIXED FIXED-SATELLITE (space-to-Earth) 5.516.B 5.523A MOBILE		
19.3-19.7 FIXED FIXED-SATELLITE (space-to-Earth) (Earth-to-space) 5.523B 5.523C 5.523D 5.523E MOBILE		
19.7-20.1 FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY Mobile-satellite (space-to-Earth) 5.524	**19.7-20.1** FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528 5.529	**19.7-20.1** FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY Mobile-satellite (space-to-Earth) 5.524
20.1-20.2 FIXED-SATELLITE (space-to-Earth) 5.484A 5.516B 5.YYY MOBILE-SATELLITE (space-to-Earth) 5.524 5.525 5.526 5.527 5.528		
20.2-21.2 FIXED-SATELLITE (space-to-Earth) 5.YYY MOBILE-SATELLITE (space-to-Earth) Standard frequency and time signal-satellite (space-to-Earth) 5.524		
21.2-21.4 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive)		
21.4-22 FIXED MOBILE BROADCASTING-SATELLITE 5.208B 5.530	**21.4-22** FIXED MOBILE	**21.4-22** FIXED MOBILE BROADCASTING-SATELLITE 5.208B 5.530 5.531

22-24.75 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
22-22.21	FIXED MOBILE except aeronautical mobile 5.149	
22.21-22.5	EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) 5.149 5.532	
22.5-22.55	FIXED MOBILE	
22.55-23.55	FIXED INTER-SATELLITE 5.338A MOBILE 5.149	
23.55-23.6	FIXED MOBILE	
23.6-24	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340	
24-24.05	AMATEUR AMATEUR-SATELLITE 5.150	
24.05-24.25	RADIOLOCATION Amateur Earth exploration-satellite (active) 5.150	
24.25-24.45 FIXED	**24.25-24.45** RADIONAVIGATION	**24.25-24.45** RADIONAVIGATION FIXED MOBILE
24.45-24.65 FIXED INTER-SATELLITE	**24.45-24.65** INTER-SATELLITE RADIONAVIGATION 5.533	**24.45-24.65** FIXED INTER-SATELLITE MOBILE RADIONAVIGATION 5.533
24.65-24.75 FIXED INTER-SATELLITE	**24.65-24.75** INTER-SATELLITE RADIOLOCATION-SATELLITE (Earth-to-space)	**24.65-24.75** FIXED INTER-SATELLITE MOBILE 5.533

24.75-29.9 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
24.75-25.25 FIXED	**24.75-25.25** FIXED-SATELLITE (Earth-to-space) 5.535	**24.75-25.25** FIXED FIXED-SATELLITE (Earth-to-space) 5.535 MOBILE
25.25-25.5	FIXED INTER-SATELLITE 5.536 MOBILE Standard frequency and time signal-satellite (Earth-to-space)	
25.5-27	EARTH EXPLORATION-SATELLITE (space-to Earth) 5.536B FIXED INTER-SATELLITE 5.536 MOBILE SPACE RESEARCH (space-to-Earth) 5.536C Standard frequency and time signal-satellite (Earth-to-space) 5.536A	
27-27.5 FIXED INTER-SATELLITE 5.536 MOBILE	**27-27.5** FIXED FIXED-SATELLITE (Earth-to-space) INTER-SATELLITE 5.536 5.537 MOBILE	
27.5-28.5	FIXED 5.537A FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 5.ZZZ MOBILE 5.538 5.540	
28.5-~~29.1~~ 28.6	FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.523A 5.539 5.ZZZ MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540	
28.~~5~~6 -29.1	FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.523A 5.539 MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540	
29.1-29.5	FIXED FIXED-SATELLITE (Earth-to-space) 5.516B 5.523C 5.523E 5.535A 5.539 5.541A MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540	
29.5-29.9 FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 5.ZZZ Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space) 5.540 5.542	**29.5-29.9** FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 5.ZZZ MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.525 5.526 5.527 5.529 5.540 5.542	**29.5-29.9** FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 5.ZZZ Earth exploration-satellite (Earth-to-space) 5.541 Mobile-satellite (Earth-to-space) 5.540 5.542

29.9-34.2 GHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
29.9-30	FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.539 5.ZZZ MOBILE-SATELLITE (Earth-to-space) Earth exploration-satellite (Earth-to-space) 5.541 5.543 5.525 5.526 5.527 5.538 5.540 5.542	
30-31	FIXED-SATELLITE (Earth-to-space) 5.338A 5.ZZZ MOBILE-SATELLITE (Earth-to-space) Standard frequency and time signal-satellite (space-to-Earth) 5.542	
31-31.3	FIXED 5.338A 5.543A MOBILE Standard frequency and time signal-satellite (space-to-Earth) Space research 5.544 5.545 5.149	
31.3-31.5	EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340	
31.5-31.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile 5.149 5.546	**31.5-31.8** EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340	**31.5-31.8** EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile 5.149
31.8-32	FIXED 5.547A RADIONAVIGATION SPACE RESEARCH (deep space) (space-to-Earth) 5.547 5.547B 5.548	
32-32.3	FIXED 5.547A RADIONAVIGATION SPACE RESEARCH (deep space) (space-to-Earth) 5.547 5.547C 5.548	
32.3-33	FIXED 5.547A INTER-SATELLITE RADIONAVIGATION 5.547 5.547D 5.548	
33-33.4	FIXED 5.547A RADIONAVIGATION 5.547 5.547E	
33.4-34.2	RADIOLOCATION 5.549	

ADD USA/1.3/2

5.YYY Earth stations on board unmanned aircraft and their associated control stations (CSs) that operate as part of an Unmanned Aircraft System (UAS) may receive from geostationary satellite networks in primary allocations of the fixed- satellite service (space-to-Earth) in the following frequency bands: 10.95 – 11.20 GHz, 11.45 – 11.70 GHz, 11.70 – 12.20 GHz (in Region 2 only), 12.20 – 12.50 GHz (in Region 3 only), 12.50 – 12.75 GHz (in Regions 1 and 3 only), 17.30 – 17.70 GHz (in Region 1 only), 17.70 – 18.80 GHz and 19.70 – 21.20 GHz. Such operations shall be in accordance with the provisions of Resolution [SAT-UAS-FSS] (WRC-12). The use of these frequency bands by the aforementioned (UAS and CS) stations is limited to UAS control link communications in the space-to-Earth direction. Moreover, the operation of UAS control links in any of the above specified frequency bands does not establish priority in the Radio Regulations over any station operating in a primary service allocated to these bands, including stations operating in the fixed-satellite service, nor does it establish priority in relation to other communication links within the fixed satellite service. The UAS control link is comprised of any radio link used for the transmission of UA command and telemetry data, transmission of sense and avoid data from the UA to the associated control station, and relay of voice communication between the Air Traffic Control ("ATC") and the UA control station.

ADD USA/1.3/3

5.ZZZ Earth stations on board unmanned aircraft and their associated control stations (CSs) that operate as part of an Unmanned Aircraft System (UAS) may transmit to geostationary satellite systems on a primary basis in the fixed- satellite service (Earth-to-space) in the following frequency bands: 13.75 – 14.00 GHz, 14.00 – 14.50 GHz and 27.50 – 28.6 GHz and 29.50 – 31.00 GHz. Such operations shall be in accordance with the provisions of Resolution [SAT-UAS-FSS] (WRC-12). The use of these frequency bands by the aforementioned (UAS and CS) stations is limited to UAS control link communications in the Earth-to-space direction. Moreover, the operation of UAS control links in any of the above specified frequency bands does not establish priority in the Radio Regulations over any station operating in a primary service allocated to these bands, including stations operating in the fixed-satellite service, nor does it establish priority in relation to other communication links within the fixed satellite service. The UAS control link is comprised of any radio link used for the transmission of UA command and telemetry data, transmission of sense and avoid data from the UA to the associated control station, and relay of voice communication between the Air Traffic Control ("ATC") and the UA control station.

*These proposals supplement those already agreed for the 5GHz band related to agenda item 1.3

ADD USA/1.3/4

RESOLUTION [SAT-UAS-FSS] (WRC-12)

Use of FSS frequency bands not subject to Appendix 30A/30B for the control communications of unmanned aircraft systems in non-segregated airspaces with geostationary satellites operating in the fixed-satellite service

The World Radiocommunication Conference (Geneva, 2012),

considering

a) that worldwide use of unmanned aircraft systems (UAS) is expected to increase significantly in the near future;

b) that unmanned aircraft (UA) need to operate seamlessly with piloted aircraft in non-segregated airspace and that there is a need to provide spectrum for that purpose;

c) that the operation of UAS in non-segregated airspace requires reliable communication links, in particular to relay the air traffic control communications and for the remote pilot to control the flight;

d) that the operation of UAS in non-segregated airspace on a worldwide basis requires the development by the civil aviation community (e.g. ICAO) of international aeronautical standards and recommended practices (SARPs) for the airworthiness certification of supporting terrestrial and satellite systems;

e) that satellite radiocommunications are an essential part of UAS operations, in particular to relay transmissions beyond the horizon and include links between the unmanned aircraft and the satellite, and links between the UA Control Station (CS) and the satellite;

f) that satellite systems operating in the fixed satellite service (FSS) bands have the capability to provide the communication links mentioned in *considering* e);

g) that Annex 10 of the Convention of the ICAO contains SARPs for aeronautical radionavigation and radiocommunication systems used by international civil aviation,

further considering

a) that there is a need to limit the number of communication equipments onboard an UA;

b) that, as a dedicated satellite system for UAS is not likely, it is necessary to have use of existing and future satellite systems to accommodate the growth of the use of UAS;

c) that there are various technical methods that may be used to increase the reliability of digital communication links, e.g. modulation, coding, redundancy, etc.;

d) that for UAS communications used for the control of UA, relay of Air Traffic Control (ATC) voice communications, and sense and avoid have certain technical, operational, and regulatory requirements;

e) that the requirements in *further considering d)* can be specified for UAS use of FSS networks,

resolves

1 that for the communications for control of the unmanned aircraft (UA), Air Traffic Control (ATC) voice communications, and sense and avoid data transmission between an UA and the UA control station (CS) via geostationary satellites in the FSS, the frequency bands in Nos. 5.YYY and 5.ZZZ may be used, provided that these FSS satellite systems and the Earth Station on board the UA and the associated control stations meet the technical requirements contained in Annex 1 of this Resolution;

2 that the use of such links will be guided by the relevant SARPs established by the ICAO;

3 that the administration that issues the license for the use of UAS in these bands (licensing administration) shall ensure that such stations follow the provisions of this Resolution;

4 that UAS shall operate within the established coordination agreements of FSS operators in accordance with the provisions of Article 9 of the Radio Regulations.

requests the Secretary-General

to bring this Resolution to the attention of the ICAO.

Annex 1

Technical characteristics of fixed-satellite service systems to support control communication links of unmanned aircraft systems (UAS)

1 Introduction

UAS that fly beyond-line-of-sight (BLOS) need satellite communications to maintain aircraft control, relay Air Traffic Control (ATC) voice communications through the UA, and pass sense and avoid data between the UA and the UA Control Station (UA CS). It is likely that UA will utilize terrestrial radio communications for critical low-altitude operations, such as takeoff and landing, but switch over to satellite communications for the majority of their flight. These satellite links need to achieve high availability to meet national and international aviation requirements when flying in non-segregated airspace.

This annex contains the performance criteria that must be met and the technical characteristics of UAS control links necessary to meet them. Meeting these technical criteria will allow UAS to use FSS allocations.

The UA CS Earth Station and UA Earth Station are operated to the same regulatory limits as a conventional FSS Earth Station.

The technical characteristics of UAS to be used in assessing the forward and return (UAS) link performance via a FSS network is provided in Section 2.

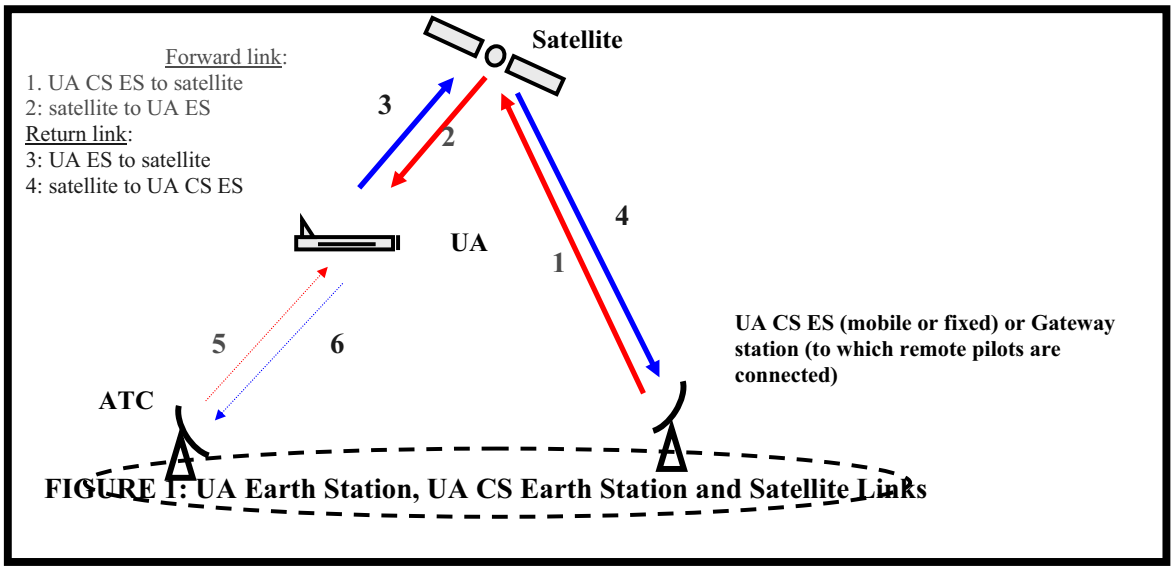

FIGURE 1: UA Earth Station, UA CS Earth Station and Satellite Links

2 Technical requirements

The technical characteristics of UAS to be used in assessing the forward and return (UAS) link performance via a FSS network is provided below. It is emphasized that an administration may implement an UAS with characteristics different than those listed below within its national airspace.

a) Frequency bands.

Space-to-Earth
10.95 – 11.20 GHz
11.45 – 11.70 GHz
11.70 – 12.20 GHz [Region 2 only]
12.20 – 12.50 GHz [Region 3 only]
12.50 – 12.75 GHz [Regions 1 and 3 only]
17.30 – 17.70 GHz in Region 1
17.70 – 18.8 GHz
19.70 – 21.20 GHz

Earth-to-Space
13.75 – 14.00 GHz
14.00 – 14.50 GHz
27.50 – 28.60 GHz
29.50 – 31.0 GHz

b) Minimum required availability for the end-to-end Forward (up 1 and down 2) Link and end-to-end Return (up 3 and down 4) Link – refer to figure 1.

End-to-end Forward (UA CS ES to UA ES) Link Availability: exceed 99.8% under the conditions contained in this Annex.

End-to-end Return (UA ES to UA CS ES) Link Availability: exceed 99.8% under the conditions contained in this Annex.

In practice, the allocation of availability to the up and down portions of each end-to-end link will not be the same; however, the combined availability of the up and down links should meet the end-to-end availability cited herein.

c) Geographic coverage area where the UAS requirements will have to be met.

Using appropriately located satellites, the availability referenced in b) should be met with the UA or UA CS at any longitude and less than +/-75 degrees latitude. The availability referenced in b) should be met with the satellite equivalent isotropically radiated power (e.i.r.p.), G/T and saturated flux density (s.f.d) at the locations of the UA CS Earth Station and UA Earth Station.

Global operations are expected covering all longitudes and latitudes to +/-75 degrees. Ranges of operation can extend to transcontinental and transoceanic distances. Flight times can extend to many days of either loitering over a specific area or flying point to point paths.

d) The rain conditions (i.e. rain rates) in which the links must operate.

UA CS Earth Stations should be designed to achieve the availability referenced in b) while accommodating the rain rates experienced in their location. Recommendation ITU-R P-837 should be used to determine the maximum UA CS Earth Station rain rates (links 1 and 4 in Figure 1) for 0.01 % of the average year and any other rain related information.

UA Earth Stations should be designed to achieve the availability referenced in b) while accommodating rain rates up to and including 20 mm/hr for 0.01% of the average year (links 2 and 3 in Figure 1). For safety reasons aircraft will be operated to mitigate very high rain rates either by flying at altitudes above the rain or by changing their flight plan to fly where rain rates are lower. Recommendation ITU-R P-837 should be used to determine any other rain related information.

e) Carrier characteristics:

It is noted that other carrier characteristics may also be suitable to achieve the required performance in b).

Information rate. Forward Link 10 kbit/s. Return Link 320 kbit/s.
Occupied bandwidth. Forward Link 9 kHz. Return Link 290 kHz.
Modulation type. QPSK
Forward error correction rate. Rate ¾ concatenated with Reed Solomon (212,236).
Minimum required C/(N+I). 3.8 dB.

f) Minimum and maximum antenna sizes and corresponding gains of the UA CS Earth Station and UA Earth Station antennas.

UA CS Earth station antennas should be sized to achieve the availability defined in b) for the rain rates experienced at their location d), as well as the other technical requirements cited in this Annex.

The minimum UA Earth Station antenna diameter should be 0.5 meters (20/30GHz) and 0.8 meters (12/14GHz). Maximum UA Earth Station antenna diameters are limited by the size and weight constraint of the UA airframe, so maximum diameters of 1.2m are anticipated The peak antenna gain values to be used in UAS Control Link performance calculations using the aforementioned antenna diameters and frequencies are provided below:

14GHz UA antenna transmit gain 38 dBi (0.8 meter) – 42 dBi (1.2 meter).
12GHz UA antenna receive gain 36 dBi (0.8 meter) – 40 dBi (1.2 meter).
30GHz UA antenna transmit gain 40 Bi (0.5 meter) – 48 dBi (1.2 meter).
20GHz UA antenna receive gain 37 dBi (0.5 meter) – 44dBi (1.2 meter).

g) Pointing accuracy of the UA Earth Station antenna.

The 12/14GHz UA Earth Station antenna tracking error not exceed +/- 0.40 degrees peak[1].

The 20/30GHz UA Earth Station antenna tracking error not exceed +/- 0.40 degrees peak.[2]

h) Maximum and minimum e.i.r.p density of the UA CS Earth Station and UA Earth Station.

14 GHz UA CS Earth Station and UA Earth Station should meet the following off-axis e.i.r.p. density levels under clear sky conditions in the plane of the geostationary satellite orbit location:

Angle off-axis	***Maximum e.i.r.p. per 4 kHz***
$1.5° \leq \theta \leq 7°$	15 – 10 log (N) - 25logθ dBW/4 kHz
$7° < \theta \leq 9.2°$	-6 – 10 log (N) dBW/4 kHz
$9.2° < \theta \leq 48°$	18 – 10 log (N) - 25logθ dBW/4 kHz
$48° < \theta \leq 85°$	-24 – 10 log (N) dBW/4 kHz
$85° < \theta \leq 180°$	-14 – 10 log (N) dBW/4 kHz

where θ is the angle in degrees from the line connecting the antenna to the target satellite. The e.i.r.p density should be met with the maximum antenna pointing error referenced in g). For digital SCPC using frequency division multiplex access (FDMA) or time division multiple access (TDMA) technique, N is equal to one. For digital SCPC using code division multiple access (CDMA) technique, N is the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

30 GHz UA CS Earth Station and UA Earth Station should meet the following off-axis e.i.r.p. density levels under clear sky conditions in the plane of the geostationary satellite orbit location:

Angle off-axis	***Maximum e.i.r.p. per 40 kHz***
$2.0° \leq \theta \leq 7°$	(18.5 – 25 log θ) – 10 log (N) dB (W/40 kHz)
$7° < \theta \leq 9.23°$	-2.63 – 10 log (N) dB (W/40 kHz)
$9.23° < \theta \leq 48°$	(21.5 – 25 log θ) – 10 log (N) dB (W/40 kHz)
$48° < \theta \leq 180°$	-10.5 dB – 10 log (N) (W/40 kHz).

where θ is the angle in degrees from the line connecting the antenna to the target satellite. The e.i.r.p. density should be met with the maximum antenna pointing error referenced in g). For digital SCPC using frequency division multiplex access (FDMA) or time division multiple access (TDMA) technique, N is equal to one. For digital SCPC using code division multiple access (CDMA) technique, N is the maximum number of co-frequency simultaneously transmitting earth stations in the same satellite receiving beam.

[1] Additional study is required to verify the correct antenna tracking/pointing error.

[2] Id.

i) Minimum G/T of the receiving UA CS Earth Station and UA Earth Station.

The UA Earth Station system noise temperature should not exceed 270º Kelvin at the antenna feed flange. G/Ts will depend on the antenna size used. UA CS Earth station G/Ts are the same as conventional FSS systems.

DOCUMENT WAC/095(26.10.10)

WAC Informal Working Group (IWG)-1

Modifications to NTIA's Proposal on
Agenda Item 1.9

Preparation for ITU Radiocommunication Conferences

UNITED STATES OF AMERICA
DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 1.9: to revise frequencies and channeling arrangements of Appendix **17** to the Radio Regulations, in accordance with Resolution **351** (**Rev.WRC-07**), in order to implement new digital technologies for the maritime mobile service

Background Information: The introduction of new data exchange technologies[1] in the HF maritime mobile service is providing an alternative to narrow-band direct printing (NBDP) technology. According to the International Maritime Organization, current NBDP applications include maritime safety information (MSI) broadcasts, ship reporting, weather forecasts and business communications (e.g. fishing fleets). Since alternative data communication technologies for these functions are available, NBDP equipment use is in rapid decline. However, NBDP telegraphy remains essential for distress communications in the polar regions (sea area A4) where geostationary satellites cannot provide coverage and other terrestrial means of communication are unreliable.

The global maritime community intends to improve efficiency and flexibility in the HF maritime mobile service spectrum by designating certain assignable frequencies in Appendix **17** to data transmissions using new data exchange technologies. This proposal would:

1) significantly reduce the number of NBDP frequencies to those actually used for NBDP telegraphy and the GMDSS/NBDP core frequencies (Appendix **15**);

2) allow for the use of the current NBDP bands for digital data transmissions, subject to not claiming protection from nor causing harmful interference to other stations in the maritime mobile service using NBDP technology until December 31, 2014;

~~3) make new digital data transmissions primary in the current NBDP bands effective January 1, 2015, though stations could use NBDP technology subject to not claiming protection from nor causing harmful interference to stations in the maritime mobile service using digital data transmissions;~~

3) re-designate the frequencies currently assignable to stations using facsimile, wide-band telegraphy and Morse telegraphy A1A/A1B to stations using data transmission without a transition period;

~~5) neither specify nor limit the bandwidth of new digital transmissions;~~

[1] See Recommendation ITU-R M.1798 *Characteristics of HF radio equipment for the exchange of digital data and electronic mail in the maritime mobile service*

4) allow stations using wide-band telegraphy or Morse telegraphy A1A/A1B to continue on their currently assigned frequencies subject to not claiming protection from nor causing harmful interference to stations in the maritime mobile service using digital data transmissions;

5) not modify Appendix **25** radiotelephony bands, but would allow for the use of digitally modulated emissions in the radiotelephony bands in accordance with the Appendix **25** allotment plan; and

6) provide some flexibility to administrations in portions of the bands 4 MHz, 6 **M**Hz and 8 MHz to assign new simplex radiotelephony frequencies in accordance with No. **52.177**, subject to not claiming protection from stations **in** the maritime mobile service using digital data transmissions.

Proposal:

MOD USA/AI 1.9/1

APPENDIX 17 (REV.WRC-12)

Frequencies and channelling arrangements in the high-frequency bands for the maritime mobile service

(See Article **52**)

PART A – Table of subdivided bands (WRC-12)

In the Table, where appropriate[1], the assignable frequencies in a given band for each usage are:

– indicated by the lowest and highest frequency, in heavy type, assigned in that band;

– regularly spaced, the number of assignable frequencies (*f.*) and the spacing in kHz being indicated in italics.

[1] Within the non-shaded boxes.

Table of frequencies (kHz) to be used in the band between 4 000 kHz and 27 500 kHz allocated exclusively to the maritime mobile service

Band (MHz)	4	6	8	12	16	18/19	22	25/26
Limits (kHz)	4 063	6 200	8 195	12 230	16 360	18 780	22 000	25 070
Frequencies assignable to ship stations for oceanographic data transmission *c)*	**4 063.3** to **4 064.8** *6 f. 0.3 kHz*							
Limits (kHz)	4 065	6 200	8 195	12 230	16 360	18 780	22 000	25 070
Frequencies assignable to ship stations for telephony, duplex operation *a) i) hh)*	**4 066.4** to **4 144.4** *27 f. 3 kHz*	**6 201.4** to **6 222.4** *8 f. 3 kHz*	**8 196.4** to **8 292.4** *33 f. 3 kHz*	**12 231.4** to **12 351.4** *41 f. 3 kHz*	**16 361.4** to **16 526.4** *56 f. 3 kHz*	**18 781.4** to **18 823.4** *15 f. 3 kHz*	**22 001.4** to **22 157.4** *53 f. 3 kHz*	**25 071.4** to **25 098.4** *10 f. 3 kHz*
Limits (kHz)	4 146	6 224	8 294	12 353	16 528	18 825	22 159	25 100

Table of frequencies (kHz) to be used in the band between 4 000 kHz and 27 500 kHz allocated exclusively to the maritime mobile service (*continued*)

Band (MHz)	4	6	8	12	16	18/19	22	25/26
Limits (kHz)	4 146	6 224	8 294	12 353	16 528	18 825	22 159	25 100
Frequencies assignable to ship stations and coast stations for telephony, simplex operation *a) hh)*	**4 147.4** to **4 150.4** *2 f. 3 kHz*	**6 225.4** to **6 231.4** *3 f. 3 kHz*	**8 295.4** to **8 298.4** *2 f. 3 kHz*	**12 354.4** to **12 366.4** *5 f. 3 kHz*	**16 529.4** to **16 547.4** *7 f. 3 kHz*	**18 826.4** to **18 844.4** *7 f. 3 kHz*	**22 160.4** to **22 178.4** *7 f. 3 kHz*	**25 101.4** to **25 119.4** *7 f. 3 kHz*
Limits (kHz)	4 152	6 233	8 300	12 368	16 549	18 846	22 180	25 121
Frequencies assignable to ship stations for data transmission *p) ee)*								*z*
Limits (kHz)	4 172	6 261	8 340	12 420	16 617	18 870	22 240	25 161.25
Frequencies assignable to ship stations for oceanographic data transmission *c) p)*								
Limits (kHz)	4 172	6 262.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25
Frequencies assignable to ship stations for data transmission *d) p)* ~~*aa) bb)*~~ *cc)*								
Limits (kHz)	4 175.25	6 266.25	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25

Frequencies (paired) assignable to ship stations for narrow-band direct-printing (NBDP) telegraphy and data transmission systems at speeds not exceeding 100 Bd for FSK and 200 Bd for PSK *d) j)*	**4 176** to **4 178** *5 f. 0.5 kHz*	**6 266.5** to **6 268.5** *5 f. 0.5 kHz*						
Limits (kHz)	4 178.25	6 268.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25
Frequencies assignable to ship stations for data transmission *d) p) ~~aa) bb)~~ cc)*								
Limits (kHz)	4 181.75	6 275.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25

Table of frequencies (kHz) to be used in the band between 4 000 kHz and 27 500 kHz allocated exclusively to the maritime mobile service (*continued*)

Band (MHz)	**4**	**6**	**8**	**12**	**16**	**18/19**	**22**	**25/26**
Limits (kHz)	4 181.75	6 275.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25
Frequencies assignable to ship stations for data transmission *p) m)*								
Limits (kHz)	4 186.75	6 280.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25
Frequencies assignable to ship stations for data transmission *d) p) ~~aa) bb)~~ cc)*								
Limits (kHz)	4 186.75	6 284.75	8 341.75	12 421.75	16 618.75	18 870	22 241.75	25 161.25
Frequencies assignable to ship stations for data transmission *m) p)*								
Limits (kHz)	4 202.25	6 300.25	8 365.75	12 476.75	16 683.25	18 870	22 279.25	25 171.25
Frequencies assignable to ship stations for data transmission *p) m)*								
Limits (kHz)	4 202.25	6 300.25	8 370.75	12 476.75	16 683.25	18 870	22 284.25	25 172.75
Frequencies assignable to ship stations for data transmission *) p) m)*								
Limits (kHz)	4 202.25	6 300.25	8 376.25	12 476.75	16 683.25	18 870	22 284.25	25 172.75

Table of frequencies (kHz) to be used in the band between 4 000 kHz and 27 500 kHz allocated exclusively to the maritime mobile service (*continued*))

Band (MHz)	**4**	**6**	**8**	**12**	**16**	**18/19**	**22**	**25/26**
Limits (kHz)	4 202.25	6 300.25	8 376.25	12 476.75	16 683.25	18 870	22 284.25	25 172.75
Frequencies (paired) assignable to ship stations for NBDP telegraphy and data transmission systems at speeds not exceeding 100 bauds for FSK and 200 bauds for PSK *d) j)*			**8 376.5** to **8 378.5** *5 f. 0.5 kHz*					
Limits (kHz)	4 202.25	6 300.25	8 378.75	12 476.75	16 683.25	18 870	22 284.25	25 172.75
Frequencies assignable to ship stations for data transmission *d) p) ~~aa) bb)~~ cc) ii)*								
Limits (kHz)	4 202.25	6 300.25	8 396.25	12 517.25	16 693.25	18 892.75	22 351.75	25 192.75
Frequencies (paired) assignable to ship stations for NBDP telegraphy and data transmission systems at speeds not exceeding 100 bauds for FSK and 200 bauds for PSK *d) j)*				**12 517.5** to **12 522** *10 f. 0.5 kHz*	**16 693.5** to **16 696.5** *7 f. 0.5 kHz*			
Limits (kHz)	4 202.25	6 300.25	8 396.25	12 522.25	16 696.75	18 892.75	22 351.75	25 192.75
Frequencies assignable to ship stations for data transmission *d) p) ~~aa) bb)~~ cc)*								
Limits (kHz)	4 202.25	6 300.25	8 396.25	12 549.75	16 733.75	18 892.75	22 351.75	25 192.75
Frequencies assignable to ship stations for data transmission *m) p)*								
Limits (kHz)	4 202.25	6 300.25	8 396.25	12 554.75	16 738.75	18 892.75	22 351.75	25 192.75
Frequencies assignable to ship stations for data transmission *~~aa) bb)~~ cc) d) p)*								
Limits (kHz)	4 202.25	6 300.25	8 396.25	12 559.75	16 784.75	18 892.75	22 351.75	25 192.75

Table of frequencies (kHz) to be used in the band between 4 000 kHz and 27 500 kHz allocated exclusively to the maritime mobile service (*continued*)

Limits (kHz)	4 202.25	6 300.25	8 396.25	12 559.75	16 784.75	18 892.75	22 351.75	25 192.75
Frequencies (non paired) assignable to ship stations for data transmission systems *b) p) dd) gg) m) ii)*								
Limits (kHz)	4 207.25	6 311.75	8 414.25	12 576.75	16 804.25	18 898.25	22 374.25	25 208.25
Frequencies assignable to ship stations for digital selective calling *k) l)*	**4 207.5** to **4 209** *4 f. 0.5 kHz*	**6 312** to **6 313.5** *4 f. 0.5 kHz*	**8 414.5** to **8 416** *4 f. 0.5 kHz*	**12 577** to **12 578.5** *4 f. 0.5 kHz*	**16 804.5** to **16 806** *4 f. 0.5 kHz*	**18 898.5** to **18 899.5** *3 f. 0.5 kHz*	**22 374.5** to **22 375.5** *3 f. 0.5 kHz*	**25 208.5** to **25 209.5** *3 f. 0.5 kHz*
Limits (kHz)	4 209.25	6 313.75	8 416.25	12 578.75	16 806.25	18 899.75	22 375.75	25 210
Limits (kHz)	4 209.25	6 313.75	8 416.25	12 578.75	16 806.25	19 680.25	22 375.75	26 100.25
Frequencies assignable to coast stations for data transmission *n) o) p) ~~aa) bb)~~ cc)*								
Limits (kHz)	4 213.75	6 317.75	8 416.25	12 619.75	16 816.75	19 703.25	22 443.75	26 120.75
Frequencies (paired) assignable to coast stations for NBDP and data transmission systems, at speeds not exceeding 100 Bd for FSK and 200 Bd for PSK *d)*	**4 214** to **4 215.5** *4 f. 0.5 kHz*	**6 318** to **6 319.5** *4 f. 0.5 kHz*	**8 416.5** to **8 418.5** *5 f. 0.5 kHz*	**12 620** to **12 624** *9 f. 0.5 kHz*	**16 817** to **16 819.5** *6 f. 0.5 kHz*			
Limits (kHz)	4 215.75	6 319.75	8 418.75	12 624.25	16 819.75	19 703.25	22 443.75	26 120.75
Frequencies assignable to coast stations for data transmission *d) p) ~~aa) bb)~~ cc) ii)*								
Limits (kHz)	4 219.25	6 330.75	8 436.25	12 656.75	16 902.75	19 703.25	22 443.75	26 120.75
Frequencies assignable to coast stations for digital selective calling *l)*	**4 219.5** to **4 220.5** *3 f. 0.5 kHz*	**6 331** to **6 332** *3 f. 0.5 kHz*	**8 436.5** to **8 437.5** *3 f. 0.5 kHz*	**12 657** to **12 658** *3 f. 0.5 kHz*	**16 903** to **16 904** *3 f. 0.5 kHz*	**19 703.5** to **19 704.5** *3 f. 0.5 kHz*	**22 444** to **22 445** *3 f. 0.5 kHz*	**26 121** to **26 122** *3 f. 0.5 kHz*
Limits (kHz)	4 221	6 332.5	8 438	12 658.5	16 904.5	19 705	22 445.5	26 122.5

Table of frequencies (kHz) to be used in the band between 4 000 kHz and 27 500 kHz allocated exclusively to the maritime mobile service (*end*)

Band (MHz)	**4**	**6**	**8**	**12**	**16**	**18/19**	**22**	**25/26**
Limits (kHz)	4 221	6 332.5	8 438	12 658.5	16 904.5	19 705	22 445.5	26 122.5
Frequencies assignable to coast stations for wide-band, facsimile, special and data transmission systems and direct-printing telegraphy systems *m) p) ee) ff)*								
Limits (kHz)	4 351	6 501	8 707	13 077	17 242	19 755	22 696	26 145
Frequencies assignable to coast stations for telephony, duplex operation *a) hh)*	**4 352.4** to **4 436.4** *29 f. 3 kHz*	**6 502.4** to **6 523.4** *8 f. 3 kHz*	**8 708.4** to **8 813.4** *36 f. 3 kHz*	**13 078.4** to **13 198.4** *41 f. 3 kHz*	**17 243.4** to **17 408.4** *56 f. 3 kHz*	**19 756.4** to **19 798.4** *15 f. 3 kHz*	**22 697.4** to **22 853.4** *53 f. 3 kHz*	**26 146.4** to **26 173.4** *10 f. 3 kHz*
Limits (kHz)	4 438	6 525	8 815	13 200	17 410	19 800	22 855	26 175

NOC USA/AI 1.9/2

Note *a)*

Reasons: Maintains the frequency bands dedicated for the radiotelephony simplex operation.

SUP USA/AI 1.9/3

Note *b)*

Reasons: After the entry into force date of 1 January 2015, Section III, Part B this note will no longer be required.

NOC USA/AI 1.9/4

Note c) and *d)*.

Reasons: Maintains frequencies for transmission of oceanographic data and paired frequencies for NBDP.

SUP USA/AI 1.9/5

Note *e)*

Reasons: Maintains frequencies for ship stations using A1A Morse telegraphy not travelling faster than 40 Bd

SUP USA/AI 1.9/6

Note *f)*

Reasons: Part B, Section V is proposed for suppression.

SUP USA/AI 1.9/7

Note *g)*

Reasons: Part B, Section IV is proposed for suppression.

NOC USA/AI 1.9/8

Note *i)* to *l)*

Reasons: Maintains paired frequencies for digital selective calling.

MOD USA/AI 1.9/9

Note *m)* Frequencies from these frequency bands may also be used for A1A or A1B Morse telegraphy subject to not claiming protection from other stations, in the maritime mobile service .

Reasons: Assigns additional frequencies for A1A or A1B Morse telegraphy subject to protection of the maritime mobile service using new digital technologies.

NOC USA/AI 1.9/10

Note *n)* and *o)*

Reasons: No change is proposed to frequencies used for maritime safety information (MSI) and Navigational Telex (NAVTEX).

MOD USA/AI 1.9/11

Note *p)* These sub-bands, except the frequencies referred to in Notes *i), j)*, *n)* and *o)*, may be used for ~~for~~ maritime mobile service ~~(e.g.~~ as described in Recommendation ITU-R M.1798~~)~~. The bandwidth of digital emissions should~~all~~ not exceed ~~be no more than~~ 20 kHz.

Reasons: Implements the channels for new digital technologies in the frequency bands designated for wide-band telegraphy, and facsimile without transition a period.

~~**ADD** USA/AI 1.9/12~~

~~Note *aa)* Until 1 January 2015, these bands may be used by narrow-band direct printing applications.~~

~~**Reasons**: Allows for transition period for frequencies employing NBDP to transmission of new digital technologies subject to not causing interference into NBDP.~~

~~**ADD** USA/AI 1.9/13~~

~~Note *bb)* After 1 January 2015, these bands may be used by narrow-band direct printing applications by the administrations, subject to not claiming protection from other stations.~~

~~**Reasons**: Allows for continued use of NBDP after transition date subject to not claiming protection from the maritime mobile service.~~

ADD USA/AI 1.9/14

Note *cc)* After 1 January 2015, the administrations who make assignments to stations using digitally modulated emissions are encouraged to effect coordination with potentially affected administrations.

Reasons: Removes the use of single channel NBDP after 1 January 2015 to allow the introduction of new HF data exchange technologies into the maritime mobile service.

ADD USA/AI 1.9/15

Note *dd)* These bands may be used by narrow-band direct printing applications by the administrations, subject to not claiming protection from other stations

Reasons: Removes the use of single channel NBDP after 1 January 2015 to allow the introduction of new HF data exchange technologies into the maritime mobile service.

ADD USA/AI 1.9/16

Note *ee)* Frequencies from these bands may be used for wide-band telegraphy, facsimile, A1A Morse telegraphy and special data transmission on condition that harmful interference is not caused to and protection is not claimed from stations, in the maritime mobile .

.

Reasons: Removes the use of single channel NBDP after 1 January 2015 to allow the introduction of new HF data exchange technologies into the maritime mobile service.

ADD USA/AI 1.9/17

Note *ff)* The bands 4 345 – 4 351 kHz, 6 495 – 6 501 kHz, 8 701 – 8 707 kHz may be used for simplex (single-sideband) telephone operation (regularly spaced by 3 kHz), in accordance with provision No. **52.177**, subject to not claiming protection from other stations in the maritime mobile service .

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Reasons: Removes the use of single channel NBDP after 1 January 2015 to allow the introduction of new HF data exchange technologies into the maritime mobile service.

ADD USA/AI 1.9/18

Note *gg)* When assigning frequencies on the bands 4 202.25 – 4 207.25 kHz, 6 300.25 – 6 311.75 kHz, 8 396.25 – 8 414.25 kHz, 12 559.75 – 12 576.75 kHz and 16 784.75 – 16 804.25 kHz, administrations shall take all necessary precautions to not cause interference on the DSC distress frequencies 4 207.5 kHz, 6 312 kHz, 8 414.5 kHz, 12.577 kHz and 16 804.5 kHz.

Reasons: Provides protection for DSC distress frequencies.

ADD USA/AI 1.9/19

Note *hh)* The bands 4 066.4 – 4 150.4 kHz, 4 352.4 – 4 436.4 kHz, 6 201.4 – 6 231.4 kHz, 6 502.4 – 6 523.4 kHz, 8 196.4 – 8 298.4 kHz, 8 708.4 – 8 813.4 kHz, 12 231.4 – 12 366.4 kHz, 13 078.4 – 13 198.4 kHz, 16 361.4 – 16574.4 kHz, 17 243.4 – 17 408.4 kHz, 18 781.4 – 18 844.4 kHz,19 756.4 -19 798.4 kHz, 22 001.4 – 22 178.4 kHz, 22 697.4 – 22 853.4 kHz, 25 071.4 – 25 119.4 kHz, 26 146.4 – 26 173.4 kHz may be used, in accordance with Appendix **25** allotment plan, for digitally modulated emissions on condition that harmful interference is not caused to and protection is not claimed from other stations in the maritime mobile service using radiotelephony operations. The digitally modulated emissions may be used provided that their occupied bandwidth does not exceed 2 800 Hz, it is situated wholly within one frequency channel and the peak envelope power of coast stations does not exceed 10 kW and the peak envelope power of ship stations does not exceed 1.5 kW for per channel.

Reasons: Allows additional use fordigitally modulated emission sin the RR Appendix **25** bands.

ADD USA/AI 1.9/20

Note *ii)* Peak envelope power for data transmission systems in these channels must not exceed 1.5kW for ships and 10kW for coast stations and their occupied bandwidth must not exceed 2800Hz.

Reasons: Allows continued NBDP operation and a degree of protection from interference.

PART B – Channelling arrangements (WRC-12)

Section II – Narrow-band direct-printing telegraphy (paired frequencies)

MOD USA/AI 1.9/20

TABLE 17a

Table of frequencies for two-frequency operation by coast stations (kHz)

Reasons: Providing a table number will help distinguish this table from new the table (17b) that comes into force after January 1, 2015.

NOC USA/AI 1.9/21

Channel	4 MHz band[1]	6 MHz band[3]	8 MHz band[4]

No.	Transmit	Receive	Transmit	Receive	Transmit	Receive

Reasons: There are no proposed changes to the table (17a).

ADD USA/AI 1.9/22

TABLE 17b (WRC-12)

Table of frequencies for two-frequency operation by coast stations (kHz)

Channel No.	4 MHz band [1]		6 MHz band		8 MHz band	
	Transmit	**Receive**	**Transmit**	**Receive**	**Transmit**	**Receive**
1 2 3 4 5					8 376.5 [2] 8 417 8 417.5 8 418 8 418.5	8 376.5 [2] 8 377 8 377.5 8 378 8 378.5
6 7 8 9 10	4 214 4 214.5 4 215	4 176 4 176.5 4 177	6 318 6 318.5 6 319	6 266.5 6 267 6 267.5		
11 12 13	4 177.5 [2] 4 215.5	4 177.5 [2] 4 178	6 268 [2] 6 319.5	6 268 [2] 6 268.5		

[1] Ship stations may use the coast station receiving frequencies for transmitting A1A or A1B Morse telegraphy (working), with the exception of channel No. 11 (see Appendix **15**).

[2] For the conditions of use of this frequency, see Article **31**.

TABLE 17b (end)

Channel No.	12 MHz band		16 MHz band	
	Transmit	Receive	Transmit	Receive
21			16 817	16 693.5
22			16 817.5	16 694
23			16 818	16 694.5
24			16 695 [2]	16 695 [2]
25			16 818.5	16 695.5
26			16 819	16 696
27			16 819.5	16 696.5
82	12 620	12 517.5		
83	12 620.5	12 518		
84	12 621	12 518.5		
85	12 621.5	12 519		
86	12 622	12 519.5		
87	12 520 [2]	12 520 [2]		
88	12 622.5	12 520.5		
89	12 623	12 521		
90	12 623.5	12 521.5		
91	12 624	12 522		

Reasons: New Table 17b allows for introduction of new HF data exchange technologies into the maritime mobile service. Numbering for the other table (17a) in Section II Part B helps distinguish between the two tables in Appendix **17**.

SUP USA/AI 1.9/23

Section III – Narrow-band direct-printing telegraphy (non-paired frequencies)

Reasons: After the entry into force date of 1 January 2015, this section will no longer be needed and will be suppressed. Article **59** references the new Resolution **XYZ.NBDP**, which abrogates this suppression.

SUP USA/AI 1.9/24

Section IV – Morse telegraphy (calling)

Reasons: Removes the use of Morse telegraphy to allow the introduction of new HF data exchange technologies into the maritime mobile service.

SUP USA/AI 1.9/25

Section V – Morse telegraphy (working)

Reasons: Removes the use of Morse telegraphy to allow the introduction of new HF data exchange technologies into the maritime mobile service.

ADD USA/AI 1.9/26

RESOLUTION XYZ.NBDP (WRC-12)

Application and abrogation of certain provisions of the Radio Regulations as revised by WRC-12

The World Radiocommunication Conference (Geneva, 2012),

considering

a) that this conference has adopted a partial revision to the Radio Regulations (RR) in accordance with its terms of reference which will enter into force on 1 January 2014;

b) that some of the provisions, as amended by this conference, need to apply as of a later date;

c) that as a general rule, new and revised Resolutions and Recommendations enter into force at the time of signing of the Final Acts of a conference;

d) that as a general rule, Resolutions and Recommendations which a WRC has decided to suppress are abrogated at the time of the signing of the Final Acts of the conference,

resolves

1 that, as of 1 January 2015, the following provisions of the RR, which are suppressed by this Conference, shall be abrogated: Table 17a of Appendix **17**, Section III of Part B of Appendix **17**;

2 that, as of 1 January 2015, the following provisions, as established by this Conference, shall enter into force: Table 17b of Appendix **17**;

Reasons: The Resolution XYZ.NBDP allows for provisions in Appendix 17 to enter into force on the agreed date of 1 January, 2015.

MOD USA/AI 1.9/27

ARTICLE 59

Entry into force and provisional application of the Radio Regulations (WRC-2000)

59.XX The other provisions of these Regulations, as revised by WRC-12, shall enter into force on 1 January 2014, with the following exceptions: (WRC-12)

59.YY – the revised provisions for which other effective dates of application are stipulated in Resolutions:

XYZ.NBDP (WRC-12)

Reasons: This reference to Resolution XYZ.NBDP allows for the transition date for the entry into force of provisions in Appendix 17 and suppress other provisions.

SUP USA/AI 1.9/28

RESOLUTION 351 (Rev.WRC-07)

Review of the frequency and channel arrangements in the HF bands allocated to the maritime mobile service contained in Appendix 17 with a view to improving efficiency through the use of new digital technology by the maritime mobile service

Reasons: All of the work related to this Resolution is complete.

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DOCUMENT WAC/096(26.10.10)

WAC Informal Working Group (IWG)-1

UNITED STATES OF AMERICA

DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 1.15: *to consider possible allocations in the range 3-50 MHz to the radiolocation service for oceanographic radar applications, taking into account the results of ITUR studies, in accordance with Resolution **612 (WRC07)**;*

Resolution **612 (WRC07)**: *Use of the radiolocation service between 3 and 50 MHz to support high-frequency oceanographic radar operations*

Background Information: WRC-12 Agenda item 1.15 calls for the consideration of the creation of radiolocation allocations in the 3 to 50 MHz range. These allocations will be used for the operation of oceanographic radars that map ocean surface currents, monitor the sea state and wave heights, and track large objects. These radars will have an operational range which will not be greater than 300 km.

Oceanographic radars have been operating in the 3 to 50 MHz range since the 1970s under Radio Regulations No. **4.4** in the United States, Germany, France, Australia, Korea, India, Japan, China, and the United Kingdom. Experimental use has allowed development of radar technology to identify suitable spectrum in terms of both compatibility with other users and effectiveness for ocean measurements. The need for data to mitigate the effects of disasters, including tsunamis, to understand climate change, and to ensure safe maritime travel has led to the consideration of operational use of oceanographic radar networks on a global basis. Increased reliance on the data from these systems for maritime safety, search and rescue, oil spill disaster response, oceanographic, climatological, meteorological research has driven the need to improve the regulatory status of the spectrum which is used by oceanographic radars while taking into account the protection of existing allocated services.

Summary of technical and operational studies and relevant ITU-R Recommendations:

Existing relevant ITU-R Recommendations and Reports: :
Recommendation ITU-R P.368 Ground-wave curves for frequencies between 10 kHz and 30 MHz Recommendation ITU-R P.372 Radio noise
Recommendation ITU-R P.533 Method for the prediction of the performance of HF circuits
Recommendation ITU-R P.1546 Method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 3 000 MHz

New relevant ITU-R Recommendations and Reports:
Draft new Recommendation ITU-R M.1874
Preliminary Draft New Report ITUR M.[RLS 3-50 MHz Sharing].

Multiple sub-bands are required within the range of 3 to 50 MHz for providing long range data as well as high resolution data. Manufacturers and researchers have settled on frequencies for experimental licenses near 4.5 MHz ± 1 MHz, 8.5 MHz ± 1 MHz, 13 MHz ± 1 MHz, 26 MHz ± 4 MHz and 43 MHz ± 4 MHz to meet scientific and operational requirements. This does not imply that 2 to 6 MHz are required in each range; actual spectrum requirements are much lower, as discussed below.

Sharing studies have focused on compatibility in the bands used by fixed service and/or land mobile service only for the following reasons:

- Sharing with Amateur, Broadcasting Services, and Radio Astronomy seems to be difficult due to their protection criteria requirements.
- Sharing with Maritime Mobile, Aeronautical Mobile (R) and Standard Time and Frequency Services should be avoided due to the safety aspects of their operations.

The bands, considered most suitable fall in the Fixed and Land Mobile bands. Based on prior experience, Table 1 below lists bands that have been utilized most frequently in the past, and are therefore proposed for primary radiolocation licensing.

Table 1

Band	**Operational Needs Proposed for Oceanographic Radars** (resolution)	**Most Suitable Band**	**Services**
4.5 ± 1 MHz	2 * 25 + 10 kHz [60 kHz total] (25 kHz for 6 km)	4 440 – 4 500 kHz	FIXED, MOBILE exc. AM(R)
13 ± 1 MHz	1 * 100 + 10 kHz [2*110 kHz total] (100 kHz for 1.5 km)	13 410-13 530 kHz 13 870-13 990 kHz	FIXED, Mobile exc AM(R) FIXED, Mobile exc AM(R)
26 ± 4 MHz	2 * 200 + 30 kHz [430 kHz total] (200 kHz for 750 m)	25 330-25 550 kHz 26 200-26 420 kHz	FIXED, MOBILE exc AM
43 ± 4 MHz	2 * 375 + 50 kHz [800 kHz total] (375 kHz for 400 m)	41 600-42 400 kHz	FIXED, MOBILE

An oceanographic radar installation may use one or more of the frequency bands listed in Table 1, and it is possible to share the same bandwidth by oceanographic radar systems.

Analysis of the Results of Sharing Studies

PDN Report M.[RLS 3-50 MHz Sharing] contains sharing studies between oceanographic radiolocation systems and the fixed service and the land mobile service in the bands listed in Table 1. Refer to that Report for results.

HF Oceanographic Radars for 40 Years Operating Under Experimental Licenses

Starting with one or two HF radars in 1970 that first measured current and waves, and increasing in number to over 300 worldwide today (most operating continuously in real time), this evolving experience under experimental licenses has produced much information about impacts regarding interference to others. All of these radars have radiated on fixed frequencies. In the U.S. alone, there are approximately 25 approved HF radar frequencies licensed for experimental use. The signals employ bandwidths from 18 kHz to 500 kHz, depending on the band of operation (from 4 to 45 MHz). At frequencies above 10 MHz, there have never been any complaints of interference to other users over a 30-year period, except when an operator set a wrong frequency by mistake. At lower frequencies, there have been complaints from one or two primary license holders who heard the signals in a skywave mode; as a remedy, the HF radar ceased operating on that frequency. In those cases, the licensing agency assigned the experimental licenses unaware of another active primary license holder on that channel. At two or three of the lower HF frequencies, operation has continued for years with no interference complaints.

Under a future proposed primary licensing arrangement, the number of these 25 HF frequencies could be reduced (rather than increased), even as the number of radars grows, so that there might be two channels per each of the four/five bands. Each channel, with adequate bandwidth for the signal's required range resolution, could accommodate many HF radars, using newly developed and proven modulation synchronization and sharing methods.

Four decades' experience has also shown that distances at which the HF radar interference is received are always significantly less than those predicted in modeling studies. This is attributed primarily to two factors:

1. External noise seen in practice is always higher than that predicted from surveys, such as CCIR Report 322-3. Often reality is 25 dB higher than predictions, and always at least 5 dB higher. This means that the noise into a receiver will mask any interfering signal below that level.

2. The assumption of flat ground behind the HF radar antenna used in studies is never the situation seen in practice. Trees and other foliage, terrain and hills higher than the coastal radar's elevation, and buildings attenuate the potentially interfering signal significantly, beyond that of the idealized flat or smooth spherical earth models that have formed the basis of sharing studies.

Proposal:

Article 5
Section IV – Table of Frequency Allocations
(See No. 2.1)

MOD USA/AI 1.15/1

3 230 – 5 003 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
4 438-~~4 650~~4 400 FIXED MOBILE except aeronautical mobile (R)		**4 438-~~4 650~~4 400** FIXED MOBILE except aeronautical mobile
4 440-4 500 FIXED MOBILE except aeronautical mobile (R) RADIOLOCATION 5.XXX		**4 440-4 500** FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.XXX
~~4 438~~4 500-4 650 FIXED MOBILE except aeronautical mobile (R)		**~~4 438~~4 500-4 650** FIXED MOBILE except aeronautical mobile

ADD USA/AI 1.15/2

5.XXX Stations in the radiolocation service shall not claim protection from existing stations in other primary services and RESOLUTION 612 (REV. WRC-12) shall apply.

Reason: Allocations to the Radiolocation (oceanographic radars) service are proposed because previous experience under experimental licenses (No. **4.4**) has demonstrated compatibility with other services.

MOD USA/AI 1.15/3

13 360 – 18 030 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
13 360-13 410	FIXED RADIO ASTRONOMY 5.149	
13 410-~~13 570~~13 530	FIXED Mobile except aeronautical mobile (R), 5.150 RADIOLOCATION 5.XXX	
13 530-13 570	FIXED Mobile except aeronautical mobile (R) 5.150	
13 570-13 600	BROADCASTING 5.134 5.151	
13 600-13 800	BROADCASTING	
13 800-13 870	BROADCASTING 5.134 5.151	
13 870-~~14 000~~13 990	FIXED Mobile except aeronautical mobile (R) RADIOLOCATION 5.XXX	
13 990-14 000	FIXED Mobile except aeronautical mobile (R)	

MOD USA/AI 1.15/4

23 350-27 500 kHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
25 210-~~25 550~~25 330	FIXED MOBILE except aeronautical mobile	
25 330-25 550	FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.XXX	
25 550-25 670	RADIO ASTRONOMY 5.149	
25 670-26 100	BROADCASTING	
26 100-26 175	MARITIME MOBILE 5.132	
26 175-~~27 500~~26 200	FIXED MOBILE except aeronautical mobile 5.150	
26 200-26 420	FIXED MOBILE except aeronautical mobile, 5.150 RADIOLOCATION 5.XXX	
26 420-27 500	FIXED MOBILE except aeronautical mobile 5.150	

MOD USA/AI 1.15/5

27.5-47 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
41.015-~~44~~**41.6**	FIXED MOBILE 5.160 5.161	
41.6-42.4	FIXED MOBILE 5.160 5.161 RADIOLOCATION 5.XXX	
42.4-44	FIXED MOBILE 5.160 5.161	

MOD USA/AI 1.15/6

RESOLUTION 612 (REV. WRC-07-12)

Use of the radiolocation service between 3 and 50 MHz to support high-frequency oceanographic radar operations

The World Radiocommunication Conference (Geneva, 20072012),

considering

a) that there is increasing interest, on a global basis, in the operation of high-frequency oceanographic radars for measurement of coastal sea surface conditions to support environmental, oceanographic, meteorological, climatological, maritime and disaster mitigation operations;

b) that high-frequency oceanographic radars are also known in parts of the world as HF ocean radars, HF wave height sensing radars or HF surface wave radars;

c) that high-frequency oceanographic radars operate through the use of ground-wave propagation;

d) that high-frequency oceanographic radar technology has applications in global maritime domain awareness by allowing the long-range sensing of surface vessels, which provides a benefit to the global safety and security of shipping and ports;

e) that operation of high-frequency oceanographic radars provides benefits to society through environmental protection, disaster preparedness, public health protection, improved meteorological operations, increased coastal and maritime safety and enhancement of national economies;

f) that high-frequency oceanographic radars have been operated on an experimental basis around the world over several decades, providing an understanding of spectrum needs and spectrum sharing considerations, as well as an understanding of the benefits these systems provide;

g) that between 3 and 50 MHz, no radiolocation allocations exist;

h) thatexperience, performance, and data requirements dictate the regions of spectrum that can be used by high-frequency oceanographic radar systems for ocean observations,

recognizing

a) that ~~high-frequency~~ oceanographic radars have been operated on an experimental basis ~~for more than 30 years~~since the 1970s by several administrations;

b) that developers of the experimental systems have implemented techniques to make the most efficient use of the spectrum and mitigate interference to other radio services;

~~*c)* that the objective of Question ITU-R 240/8 is to study the most appropriate frequency bands for operation of high-frequency oceanographic radars considering both radar system requirements and the protection of existing services;~~

~~*d)* that high-frequency oceanographic radars operate with peak power levels on the order of 50 W,~~

c) that for the purpose of protecting existing services from interference, oceanographic radars shall not exceed a power flux-density at interfering points with an I/N ratio of -6 dB when referred to Recommendation ITU-R P.372-9 radio noise for quiet rural and rural;

d) that for the purpose of protecting existing services from interference, oceanographic radars' impact via ground-wave propagation can be checked by Report ITU-R M.[RLS 3-50MHz SHARING] based on Recommendation ITU-R P.368-9 and P.1546-3,

resolves

~~1 to invite ITU-R to identify high-frequency oceanographic radar system applications between 3 and 50 MHz, including bandwidth requirements, appropriate portions of this band for these applications, and other characteristics necessary to conduct sharing studies;~~

~~2 to invite ITU-R to conduct sharing analyses between the radiolocation service applications identified under *resolves* 1 and incumbent services in the bands identified to be suitable for the operation of high-frequency oceanographic radar systems;~~

~~3 that, if compatibility with existing services is confirmed under *resolves* 2, to recommend that WRC-11 consider allocations to the radiolocation service in several suitable bands between 3 and 50 MHz, as determined in the ITU-R studies, each band not exceeding 600 kHz, for the operation of oceanographic radars,~~

~~invites~~

1 that oceanographic radars shall be notified to the Bureau in accordance with No 11.2 of the Radio Regulations and that each station requires transmission of the station identification (call sign);

2 that oceanographic radars shall not operate with a peak EIRP of more than 25 dBW;

3 that oceanographic radars shall operate at the distances from the international borders as specified in the Table 1 below:

Table 1: Distances from International Borders for Placement of Oceanographic Radars

Frequency band	Land path	Sea path or mixed
4 – 16 MHz	120 km	300 km
22 – 29 MHz	100 km	160 km
40 – 50 MHz	60 km	110 km

~~*invites ITU-R*~~

~~to complete the necessary studies, as a matter of urgency, taking into account the present use of the allocated band, with a view to presenting, at the appropriate time, the technical information likely to be required as a basis for the work of WRC-11,~~

instructs the Secretary-General

to bring this Resolution to the attention of the International Maritime Organization (IMO), World Meteorological Organization (WMO) and other international and regional organizations concerned.

Reason: The Resolution was revised to reflect completion of ITU-R studies and to establish regulatory reference for the operation of the oceanographic radar between 3 and 50 MHz.

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DOCUMENT WAC/097(26.10.10)

WAC Informal Working Group (IWG)-1

United States of America

DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 8.2: *to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, taking into account Resolution 806 (WRC 07).*

Introduction

The aerospace industry is developing the future generation of commercial aircraft to provide airlines and the flying public more cost-efficient, safe, and reliable aircraft. One important way of accomplishing these aims is to reduce aircraft weight while providing multiple and redundant methods to transmit information on an aircraft. Wireless technologies can be employed to accomplish these goals while also providing environmental benefits and cost savings to manufacturers and operators.

Installed Wireless Avionics Intra-Communications (WAIC) systems are one way to derive these benefits. WAIC systems consist of radiocommunications between two or more transmitters and receivers on a single aircraft. Both the transmitter and receiver will be integrated with or installed on the aircraft. In all cases, communication is part of a closed, exclusive network required for aircraft operation. WAIC systems will not provide air-to-ground or air-to-air communications, and will only be used for safety-related applications.

ITU-R Working Party 5B has developed a Draft New Report (ITU-R M.[WAIC], Document SG05/212) that provides findings on the technical characteristics and operational requirements of WAIC systems for a single aircraft.

Because WAIC systems may impact the safety and regularity of flight of an aircraft, the International Civil Aviation Organization (ICAO) has indicated that WAIC systems should operate in a safety service allocation, which could include the Aeronautical Mobile (Route) Service or another service with similar regulatory treatment.

Because of the ICAO recommendation and anticipated WAIC bandwidth requirements, the United States believes that current AM(R)S spectrum allocations may not be sufficient to permit the introduction of WAIC systems. Accordingly, a WRC-15 agenda item is sought to conduct studies and take appropriate regulatory action to accommodate WAIC systems.

Therefore, the United States is proposing a new item for the preliminary agenda for the next World Radiocommunication Conference together with a draft resolution as shown in the attachment.

Attachment: 1

ATTACHMENT

ADD USA/5BXX/1

RESOLUTION 806 (WRC-07)

Preliminary agenda for the 2015 World Radiocommunication Conference

2.WAIC to consider spectrum requirements and possible regulatory actions, including allocations, to support wireless avionics intra-communications (WAIC) systems, based on ITU-R studies in accordance with Resolution [**WAIC-X] (WRC-12)**;

Reasons: Agenda item 8.2. WAIC is submitted as an agenda item for WRC-15 to enable the appropriate studies on the spectrum requirements and regulatory actions for wireless avionics intra-communications (WAIC) systems.

ADD USA/XX/2

RESOLUTION [WAIC-X] (WRC-12)

Consideration of regulatory actions, including allocations, for Wireless Avionics Intra-Communications (WAIC)

The World Radiocommunication Conference (Geneva, 2012),

considering

a) that the future generation of commercial aircraft is being designed to be more cost-efficient, safe, and reliable as well as environmentally friendly;

b) that WAIC systems are restricted to radiocommunications between two or more points integrated into or installed on a single aircraft;

c) that WAIC systems will be operated onboard aircraft on the ground and during all phases of flight;

d) that because WAIC systems may impact the safety and regularity of flight of an aircraft, such systems may need to operate in spectrum allocated for aeronautical mobile (route) services;

e) the potential bandwidth requirements of WAIC systems, there is a possible need for additional aeronautical mobile (route) service spectrum to support the implementation of WAIC systems;

f) that in identifying any spectrum for use by WAIC systems, there is a need to protect and not unduly constrain existing services,

recognizing

a) that WAIC systems are being developed to operate safely and efficiently in one or more non-contiguous radio frequency bands, with emphasis on those currently allocated to the aeronautical mobile service and aeronautical radionavigation service;

b) that WAIC systems operating inside an aircraft will obtain the benefits of fuselage attenuation and other aircraft surface attenuation in order to facilitate sharing with other services;

c) that studies will be required to provide a basis for considering regulatory changes, including additional allocations, designed to accommodate justified spectrum requirements of WAIC systems consistent with the protection of incumbent services,

resolves

that WRC-15 consider, based on the results of ITU-R studies, spectrum requirements and possible regulatory provisions to support the implementation of WAIC systems, including the possibility of specific allocations, without placing undue constraints on existing services in the considered bands.

invites ITU-R

1 to conduct in time for WRC-15 the necessary studies to determine the spectrum requirements and regulatory actions needed to support WAIC systems,

2 in conducting the studies in *invites 1,*to first consider spectrum within existing aeronautical mobile service and aeronautical radionavigation service allocations

3 in conducting the studies referred to in *invites* 1 and *invites* 2, to include sharing and compatibility studies with services already having allocations in potential frequency bands identified in the *resolves*,

further invites

all members of the Radiocommunication Sector and the International Civil Aviation Organization (ICAO) to contribute to these studies.

Reasons: This resolution details the scope and required studies related to future spectrum requirements of wireless avionics intra-communications systems. This resolution will enable the required analysis to determine the spectrum requirements and potential frequency bands to take place in the appropriate ITU-R Study Group(s).

Terrestrial Services

DOCUMENT WAC/100(26.10.10)

United States of America

DRAFT PROPOSAL FOR THE WORK OF THE CONFERENCE

WRC-12 Agenda Item: 1.8 *to consider the progress of ITU-R studies concerning the technical and regulatory issues relative to the fixed service in the bands between 71 GHz and 238 GHz, taking into account Resolutions 731 (WRC-2000) and 732 (WRC-2000);*
Resolution **731 (WRC-2000)**: *Consideration by a future competent world radiocommunication conference of issues dealing with sharing and adjacent-band compatibility between passive and active services above 71 GHz*
Resolution **732 (WRC-2000)**: *Consideration by a future competent world radiocommunication conference of issues dealing with sharing between active services above 71 GHz*

Background information:

WRC-2000 adopted Resolutions **731** and **732** as part of the conference decisions on the allocation of frequency bands above 71 GHz to the Earth exploration-satellite (passive) and radio astronomy services resulting in an overall rearrangement of the allocation tables in Article **5** of the Radio Regulations. These resolutions became necessary because the ITU-R was not able to fully evaluate for the active services (e.g., fixed, mobile, radiolocation, etc.), the new arrangement of their allocations vis-à-vis the passive allocations or each other. Therefore, the conference decided to adopt these two resolutions providing for further study and possible action in the future when active services technology and emerging requirements become better known. Since that time, millimeter wave spectrum above 71 GHz has become the subject of increasing interest for commercial use due to its unique propagation characteristics and the wide bandwidth available for carrying telecommunications traffic. New technologies are now emerging that offer the possibility of using these higher frequency bands for fixed wireless applications, taking advantage of the wide bandwidths available to support applications such as extremely high speed data transmission (e.g., data rates in the 1 to 10 Gbps range) for short distance (e.g., < 1-2 km). Several administrations have made or are making provisions for such wideband terrestrial fixed wireless applications. In particular, in the United States, the Fixed Service has operational links in the frequency bands 71-76 GHz, 81-86 GHz, 92-94 GHz and 94.1-95 GHz.

In a somewhat unique set of circumstances, WRC-07 did not adopt a Resolution to define this agenda item. Therefore, the definition and scope of the agenda item is unclear. Studies of out-of-band aggregate interference from FS into EESS systems in the band 86-92 GHz have been carried out in ETSI and the results of these studies have been reported to the ITU-R. The results of these studies are critically dependent on the assumed characteristics of the FS systems and their deployment. The assumed characteristics may not be representative of the current or the future deployment in many administrations. The CPM text proposes two methods for satisfying agenda item 1.8.

Method A consists of no change to the Radio Regulations at this time but with two approaches (Approach A1 – NOC Resolutions **731** and **732 (WRC-2000)**; Approach A2 – SUP Resolutions **731** and **732 (WRC-2000)** and develop new Resolutions as appropriate in the future) to allow continuation of technical and operational considerations related to FS between 71-238 GHz to be addressed in ITU-R

Reports and Recommendations as appropriate. Regulatory action can then be taken based on these ITU-R documents by a future World Radiocommunication Conference as appropriate.
Method B consists of introducing unwanted emission power masks on the FS through footnotes in RR Article **5** attached to the FS allocations in the bands 81-86 GHz and 92-95 GHz to protect the EESS in the adjacent band 86-92 GHz, with two approaches. Approach B1 proposes mandatory masks. This approach implies some limitations on the FS. Approach B2 proposes recommended masks that may constrain the FS in countries implementing the mask and may constrain the EESS in countries that are not implementing the mask.

Proposals:

NOC **USA/1.8/1**

ARTICLE 5

Reason: Administrations have not submitted enough information to substantiate the need for a change. The low level of contributions results from the fact that the technologies employed by the active services in these bands are in the early stages of development and some administrations have not even opened the bands for licensing.

SUP **USA/1.8/2**

Resolution **731 (WRC-2000)**
Resolution **732 (WRC-2000)**

Reason: These Resolutions are premature and unfocused. Resolutions that are specific to the frequency band(s) and to the services that share them can be developed at a future date as the technologies in those bands become more mature. Any such resolutions need to be included under an agenda item that requests consideration of the allocation choices made at WRC-2000 in light of the emerging needs of the active services.

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DOCUMENT WAC/101(26.10.10)

IWG-2 Recommendations regarding the US Proposal on Agenda Item 1.20

Agenda Item 1.20: *To consider the results of ITU-R studies and spectrum identification for gateway links for high altitude platform stations (HAPS) in the range between 5 850-7 075 MHz in order to support operations in the fixed and mobile services, in accordance with Resolution **734 (Rev.WRC-07)**.*

Summary

IWG-2 began considering draft US proposal on agenda item 1.20 at its August 29, 2009 meeting. After thorough discussion, and after considering multiple iterations of possible US proposals, IWG-2 members were unable to reach consensus on a recommended US proposal on agenda item 1.20. IWG-2 does not believe that it is in a position to progress the work further on this agenda item at this time. Consequently, two draft US proposals were developed.

Proposal A (contained in Attachment A to this document) is supported by Stratocomm and AeroVironment and reflects the views of these companies. IWG-2 as a whole did not review and approve the text provided in Attachment A.

Proposal B (contained in Attachment B to this document) is supported by Alcatel-Lucent, Fixed Wireless Communications Coalition, Hughes Network Systems, Globalstar, Intelsat and SES World Skies, and reflects the views of these companies. IWG-2 as a whole did not review and approve the text provided in Attachment B.

IWG-2 respectfully submits this document and two attached draft US proposals to the WRC Advisory Committee for further consideration.

ATTACHMENT A – PROPOSAL A

UNITED STATES OF AMERICA

DRAFT PROPOSAL FOR THE WORK OF THE CONFERENCE

AGENDA ITEM 1.20: *To consider the results of ITU-R studies and spectrum identification for gateway links for high altitude platform stations (HAPS) in the range between 5 850-7 075 MHz in order to support operations in the fixed and mobile services, in accordance with Resolution **734 (Rev.WRC-07)***

BACKGROUND

WRC-97 made provisions for the operation of HAPS gateway links within the FS in the bands 47.2-47.5 GHz and 47.9-48.2 GHz by Resolution **122 (Rev.WRC-07)**. Since the 47 GHz bands are susceptible to rain attenuation, WRC-2000 adopted RR Nos. **5.537A** and **5.543A**, which were modified at WRC-03 and then again at WRC-07 to permit the use of HAPS in the fixed service in the band 27.9-28.2 GHz and in the band 31-31.3 GHz in certain Region 1 and 3 countries on a non-harmful interference, non-protection basis by Resolution **145 (Rev.WRC-07)**. In addition, countries in Region 2 may use this frequency band for HAPS on a non-harmful interference, non-protection basis in accordance with Resolution **145 (Rev.WRC-07)**. Considering the high rain attenuation levels in higher frequency bands and the desirability to have greater flexibility in the choice of spectrum for gateway operations in support of HAPS networks, consideration is being given to the potential use of the 6 GHz band for HAPS gateway links.

HAPS gateway links can support backhaul connections of all types (e.g. for cellular networks and complex wireless multi-protocol networks), access to terrestrial public and private networks, data collection, exploration data, surveillance information, safety radar data, and broadcast and interactive video. Telemetry, tracking, command and control information related to the operation of the HAPS vehicle itself can also be contained in the HAPS gateway link. HAPS applications can also provide a broad spectrum of disaster response, emergency communications, remote medical assistance, distance learning, public safety and government system applications on a real time multi-mode and global basis.

PROPOSAL

MOD USA/1.20/01

5 570-7 250 MHz

Allocation to services		
Region 1	**Region 2**	**Region 3**
5 570-5 650	MARITIME RADIONAVIGATION MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B 5.450 5.451 5.452	
5 650-5 725	RADIOLOCATION MOBILE except aeronautical mobile 5.446A 5.450A Amateur Space research (deep space) 5.282 5.451 5.453 5.454 5.455	
5 725-5 830 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur 5.150 5.451 5.453 5.455 5.456	**5 725-5 830** RADIOLOCATION Amateur 5.150 5.453 5.455	
5 830-5 850 FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur Amateur-satellite (space-to-Earth) 5.150 5.451 5.453 5.455 5.456	**5 830-5 850** RADIOLOCATION Amateur Amateur-satellite (space-to-Earth) 5.150 5.453 5.455	
5 850-5 925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.150	**5 850-5 925** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation 5.150	**5 850-5 925** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Radiolocation 5.150
5 925-6 700	FIXED ADD 5.A120 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.457C 5.149 5.440 5.458	
6 700-7 075	FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE 5.458 5.458A 5.458B 5.458C	

ADD 5.A120 For Administrations, [to be identified here and as indicated by these administrations at WRC-12], wishing to implement HAPS gateway links in the following bands that are identified for use by HAPS. The allocation to the fixed service in the bands 6 440 – 6 520 MHz (HAPS-to-ground direction) and 6 560 – 6 640 MHz (ground-to-HAPS direction) may also be used by gateway links for high altitude platform stations (HAPS) within the territory of these countries. Such use of two channels of 80 MHz in the fixed service allocation by HAPS in the above countries is limited to operation in HAPS gateway links and shall not claim protection from other types of fixed service systems or other co-primary services. Resolution **[A120-HAPS-GATEWAY] (WRC-12)** shall also apply. (No. **5.43A** does not apply). Furthermore, the development of these other services shall not be constrained by HAPS gateway links.

Reason: A 6 GHz spectrum identification for HAPS gateway links with specified technical and operations constrains required by a Resolution would allow an operational HAPS system to provide real-time voice and data services while ensuring the protection of existing services.

ADD USA/1.20/02

PROPOSED RESOLUTION [A120-HAPS-GATEWAY] (WRC-12)

Use of the bands 6 440 – 6 520 MHz and 6 560 – 6 640 MHz by gateway links for high-altitude platform stations (HAPS) in the fixed service

The World Radiocommunication Conference (Geneva, 2012),

considering

a) that ITU has among its purposes "to promote the extension of the benefit of the new telecommunication technologies to all the world's inhabitants" (No. **6** of the Constitution);

b) that systems based on new technologies using high altitude platform stations (HAPS) can potentially be used for various applications such as the provision of high-capacity services to urban and rural areas;

c) that provision has been made in the Radio Regulations for the deployment of HAPS in specific bands, including as base stations to serve IMT-2000 networks;

d) that at WRC-07, a need for adequate provision for gateway links to serve HAPS operations was expressed;

e) that WRC-07 revised Resolution **734** to invite ITU-R to conduct sharing studies, with a view to identifying two channels of 80 MHz each for gateway links for HAPS in the range from 5 850 to 7 075 MHz, in bands already allocated to the fixed service, while ensuring the protection of existing services;

f) that the band 5 850-7 075 MHz is already heavily used or planned to be used by a number of different services and a number of other types of applications in the fixed service;

g) that in order to accommodate the need stated in *considering d)*, WRC-12 adopted No.**5.A120** to permit the use of HAPS gateway links in the fixed service in the bands 6 440 – 6 520 MHz and 6 560 – 6 640 MHz in the countries listed in the footnote, based on the study results in *considering e)*;

h) that while the deployment HAPS gateway links in the band 6 440 – 6 520 MHz and 6 560 – 6 640 MHz is taken on a national basis, such deployment may affect neighbouring administrations,

recognizing

a) that ITU-R has studied technical and operational characteristics of HAPS gateway links in the fixed services in part of the 6 GHz band resulting in Recommendation ITU-R F.[HAPS CHAR];
b) that ITU-R has also conducted sharing studies between HAPS gateway links and other existing services leading to Recommendations ITU-R F.[HAPS GATEWAY] and ITU-R F.[HAPS MODELLING] to provide interference evaluation methodologies based on Recommendation ITU-R F.[HAPS CHAR] referred to in *recognizing a)*;
c) that the World Summit on the Information Society has encouraged the development and application of emerging technologies to facilitate infrastructure and network development worldwide with special focus on underserved regions and areas,

noting

1 that for the purpose of protecting the Earth exploration-satellite service (passive) in the band 6 425-7 075 MHz, No. **5.458** shall apply;
2 that for the purpose of protecting the radio astronomy service in the band 6 650-6 675.2 MHz, No. **5.149** shall apply,

resolves

1 that the antenna pattern for both the HAPS platform and the HAPS gateway station in the bands 6 440 – 6 520 MHz and 6 560 – 6 640 MHz shall meet the following antenna beam patterns:

$G(\psi) = G_m - 3(\psi/\psi_b)^2$ dBi for $0° \le \psi \le \psi_1$

$G(\psi) = G_m + L_N$ dBi for $\psi_1 < \psi \le \psi_2$

$G(\psi) = X - 60 \log(\psi)$ dBi for $\psi_2 < \psi \le \psi_3$

$G(\psi) = L_F$ dBi for $\psi_3 < \psi \le 90°$

where:

$G(\psi)$: gain at the angle ψ from the main beam direction (dBi);

G_m: maximum gain in the main lobe (dBi);

ψ_b: one-half of the 3 dB beamwidth in the plane considered (3 dB below G_m) (degrees);

L_N: near side-lobe level (dB) relative to the peak gain required by the system design, and has a maximum value of –25 dB;

L_F: far side-lobe level, G_m – 73 dBi.

$\psi_1 = \psi_b \sqrt{-L_N / 3}$ degrees

$\psi_2 = 3.745\ \psi_b$ degrees

$X = G_m + L_N + 60 \log(\psi_2)$ dBi

$\psi_3 = 10^{(X - L_F)/60}$ degrees

The 3 dB beamwidth ($2\psi_b$) is estimated by:

$(\psi_b)^2 = 7\ 442/(10^{0.1G_m})$ degrees^2;

2 that the maximum angle of deviation of the HAPS airborne antenna from the nadir should be limited to 60 degrees corresponding to the UAC of the HAPS;
3 that for the purpose of protecting the FSS (Earth-to-space), the pfd of the HAPS uplink shall be limited to a maximum of –177.7 dBW/m^2 in 4 kHz toward the geostationary arc;
4 that for the purpose of protecting the fixed wireless systems in other administrations in the band 5 850-6 725 MHz, the e.i.r.p. of the HAPS downlink shall be limited to a maximum of −0.5 dBW/10 MHz for off-axis angles from nadir below 60 degrees;

Reason: A resolution is need to specify the technical and operation constraints required of HAPS systems in order to ensure the protections of services already allocated to the band.

SUP USA/1.20/03

RESOLUTION 734 (Rev.WRC-07)

Studies for spectrum identification for gateway links for high-altitude platform stations in the range from 5 850 to 7 075 MHz

Reason: Resolution 734 is no longer relevant since the requested studies have been completed.

ATTACHMENT B – PROPOSAL B

UNITED STATES OF AMERICA

DRAFT PROPOSAL FOR THE WORK OF THE CONFERENCE

AGENDA ITEM 1.20: *To consider the results of ITU-R studies and spectrum identification for gateway links for high altitude platform stations (HAPS) in the range between 5 850-7 075 MHz in order to support operations in the fixed and mobile services, in accordance with Resolution* ***734 (Rev.WRC-07)***

BACKGROUND:

Different segments of the 5 850-7 075 MHz frequency band are utilized for fixed, fixed-satellite, and mobile services. Resolution **734 (WRC-07)** invites the ITU-R to study spectrum identification for gateway links for high-altitude platform stations in the range from 5 850 to 7 075 MHz. The study effort is to identify two channels of 80 MHz each for gateway links for HAPS in the range from 5 850 to 7 075 MHz, in bands already allocated to the fixed service, while ensuring the protection of existing services.

Previous WRC efforts (WRC-97, WRC-2000) had undertaken initiatives to examine HAPS types of applications in various frequency bands. Due to the fact that all previous studies were carried out in frequency bands significantly higher than 5 850-7 075 MHz, new electromagnetic compatibility (EMC) studies were conducted. The EMC studies addressed HAPS ability to coexist with mobile, fixed satellite services as well as with radiolocation service, which exists in adjacent frequency bands.

Land-based and maritime radiolocation systems operate in the lower adjacent frequency band. Fixed, mobile, and fixed-satellite systems also operate in the 5 850-7 075 MHz band. Remote sensing systems operate in the 6 475-7 075 MHz band.

The FS band is heavily utilized for point-to-point and point-to-multipoint links in many parts of the world, in particular the bands between 5 925 to 6 875 MHz. In the US alone, there are over 42,000 licenses with multiple locations and multiple frequencies in the band 5850-6875 MHz**.** The bands were originally used for backbone high capacity systems for FM and, subsequently, digital networks. However, they are now used primarily for backhaul for cellular mobile systems, office intranet, ethernet traffic, public safety communications traffic and for delivering traffic to the public switched and data networks, involving shorter hop systems. Introducing high altitude platform links in this band for gateway stations would make it difficult to mutually coordinate either type of system in this environment. ITU-R studies demonstrate that there would be large areas surrounding HAPS gateway stations where FS would be difficult to coordinate and where, due to the presence of FS stations, gateway stations could not be installed.

The band 5 850-7025 MHz is an FSS uplink band that is heavily used worldwide by GSO FSS applications. The low atmospheric absorption in this band enables highly reliable Earth-to-space communication links with wide service coverage, particularly in, but not limited to, geographical areas with severe rain fade conditions. The wide coverage enables services to be provided in developing countries, to sparsely populated areas and over large distances.

This band has been used by the GSO FSS for over 40 years. The technology is mature and offers equipment at low cost. This, together with the wide coverage, has lead to satellites in this band being an important part of the telecommunications infrastructure in many developing countries. Satellites operating in this band are the only efficient means for providing today global satellite coverage of the Earth.

There are approximately 160 geostationary satellites operating in the band 5 850-7025 MHz, comprising a total capacity exceeding two thousand 36 MHz transponders. Moreover, about two out of three satellites in production use this band. The use of this band by the GSO FSS includes governmental uses and international commitments within the WMO and ICAO which are essential for public security, civil aviation and weather, water, climate and environmental alerts.

Satellite services in this band currently include VSAT ("Very Small Aperture Terminal") networks, internet services, point-to-point links, backhaul service (telephony, Internet), distribution of television programs, satellite news gathering, feeder-link for TV and data broadcasting to SMATV ("Satellite Master Antenna Television") and DTH ("Direct-To-Home") receivers, feeder links for the mobile satellite service. Due to their wide coverage characteristics, satellites operating in this band have been extensively used for disaster relief operations. Furthermore, in this band very high power telecommand signals, both for on-station operation and for transfer orbits (Launch and Early Operation Phase – LEOP), are required.

ITU-R studies have shown that the determining factor in sharing with the FSS is the protection of HAPS links, which would require distance separations of up to several hundred kilometers. Maintenance of such large distance separation would have a very negative impact on the US satellite licensees' ability to further develop their systems domestically and internationally.

A portion of this spectrum, the band 6 725-7 025 MHz, is the uplink band for the FSS Allotment Plan of Appendix **30B (Rev.WRC-07)** of the Radio Regulations. The fixed-satellite service Plan (RR Appendix **30B**) is intended to preserve orbit/spectrum resources for future use, on an equitable basis among all country Members of the ITU, and is of the utmost importance to developing countries that may not have the possibility to implement satellite systems in unplanned bands (that suffer more and more from congestion) in the short-and mid-terms. Use of the band is subject to the provisions of Appendix **30B** to the Radio Regulations, which sets out the regulatory and technical requirements to be met by FSS networks employing the band and also the protection to be afforded to those networks by systems of the other services having allocations in the band (currently the FS and the MS). The potential introduction of another source of interference, or another set of stations which require protection from Appendix 30B earth stations, would have a negative effect on the possibility of this Plan "guaranteeing in practice equitable access to the geostationary orbit."

Feeder-links (space-to-Earth) for non-geostationary mobile-satellite service (MSS) systems are allocated in the 6 700-7 075 MHz range, at gateway earth stations. These frequencies are utilized on a world wide basis to provide connections between remote terminals and the terrestrial infrastructure. Given the necessity of tracking low earth orbit (LEO) spacecraft, near hemi-spherical coverage of the sky is required at these gateway earth stations. The reception of signals from spacecraft requires low-noise, high sensitivity amplifiers at these stations that could be overloaded by powerful signals from HAPS gateway ground stations and HAPS platform stations. It will, thus, be very difficult to site HAPS systems and still provide the required protection to MSS feeder downlink earth stations.

In many countries, satellite systems utilizing these frequencies provide the only means for communications between these remote regions and the world telecommunications infrastructure. First responders routinely use MSS systems, of which the feeder links in this frequency range are

a part, to coordinate rescue and relief operations. One MSS system provides an emergency location beacon service for which the feeder links provide the vital connection between the MSS spacecraft and the terrestrial portion of the system. The introduction of HAPS gateway links into this frequency range could create an adverse interference environment impacting these critical applications.

The proposal below is for Method A of the draft CPM text. Method A proposes no change to the 5 850-7 075 MHz band. Under this method, it is envisaged that HAPS gateway links may be able to make use of the existing identified spectrum in the bands 47.2-47.5 GHz and 47.9-48.2 GHz in RR No. **5.552A** (and the bands 27.9-28.2 GHz and 31.0-31.3 GHz for the countries listed in RR No. **5.537A** and **5.543A**). There is no indication of requirement within or outside of the United States for HAPS in the band indicated in this agenda item or for any other band even those already identified for HAPS, and certainly not under the conditions indicated in Method B.

Proposal:

NOC USA/1.20/01

5570-7250 MHz

Allocation to Services

Region 1	Region 2	Region 3
5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.150	**5850-5925** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation 5.150	**5850-5925** FIXED FIXED-SATELLITE (Earth-to=space) MOBILE Radiolocation 5.150
5925-6700 FIXED FIXED-SATELLITE,5.457A (Earth-to-space), 5.457B MOBILE,5.457C 5.149 5.440 5.458	**5925-6700** FIXED FIXED-SATELLITE (Earth-to-space),5.457B MOBILE,5.457C 5.149,5.440,5,458	**5925-6700** FIXED FIXED-SATELLITE (Earth-to-space), 5.457B MOBILE, 5.457C 5.149,5.440,5.458
6700-7075 FIXED FIXED-SATELLITE,5.441 (Earth-to-space)(space-to-Earth) 5.458,5.458A,5.458B,5.458C	**6700-7075** FIXED FIXED-SATELLITE,5.441 (Earth-to-space)(space-to-Earth) 5.458,5.458A,5.458B,5.458C	**6700-7075** FIXED FIXED-SATELLITE,5.441 (Earth-to-space)(space-to-Earth) 5.458,5.458A,5.458B,5.458C

Reason: In the bands indicated, regulatory identification would be too difficult to achieve and sustain without causing constraint on the development of the services allocated to the bands of concern. Under

this method, it is envisaged that HAPS gateway links may be able to make use of the existing identified spectrum in the bands 47.2-47.5 GHz and 47.9-48.2 GHz in RR No. **5.552A,** which indicates that the use of these bands by HAPS is subject to the provisions of Resolution **122 (Rev.WRC-07)**. This Resolution, in its recognizing a) states that these bands are expected to be required for both gateway and ubiquitous terminal applications. It is therefore clear that there is already spectrum designated for gateway operations for HAPS.

In addition, the bands 27.9-28.2 GHz and 31.0-31.3 GHz are also available for use by HAPS in the countries listed in RR No. **5.537A** and **5.543A.** Added flexibility with respect to spectrum to be used by gateway links could be achieved by administrations by adding their name to these footnotes (in case their names were not yet in these provisions).

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Space Services

DOCUMENT WAC/099(26.10.10)

UNITED STATES OF AMERICA
DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

AGENDA ITEM 1.7:

Agenda Item 1.7: to consider the results of ITU-R studies in accordance with Resolution **222** (Rev.WRC-07) in order to ensure long-term spectrum availability and access to spectrum necessary to meet requirements for the aeronautical mobile-satellite (R) service, and to take appropriate action on this subject, while retaining unchanged the generic allocation to the mobile-satellite service in the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz.

BACKGROUND:

Prior to the 1997 World Radiocommunication Conference (WRC-97), the Radio Regulations contained an exclusive allocation to the aeronautical mobile-satellite (R) service (AMS(R)S) for the bands 1 545-1 555 MHz (space-to-Earth) and 1 646.5-1 656.5 MHz (Earth-to-space). To allow flexibility in frequency coordination and to achieve spectrum efficiency, WRC-97 changed this into a generic mobile-satellite service (MSS) allocation subject to the provision No. **5.357A** to prioritize access to the AMS(R)S spectrum with priority categories 1 to 6 of Article **44** of the Radio Regulations.

WRC-2000 adopted Resolution **222 (WRC-2000)** resolving that, in frequency coordination of MSS systems in the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz, administrations shall ensure that the spectrum needed for AMS(R)S communications within priority categories 1 to 6 of RR Article **44** in the bands where No. **5.357A** applies is accommodated. Also administrations shall ensure the use of the latest technical advances in order to achieve the most flexible and practical use of the generic allocations.

WRC-07 revised Resolution **222** to remove the request for studies to determine the feasibility and practicality of prioritization and real-time pre-emptive access issues, and invited ITU-R to carry out a number of additional studies towards ensuring long term spectrum availability for AMS(R)S.

In coordinating MSS systems under the procedure of Article **9**, the notifying administrations for MSS systems in the above bands have adopted two multilateral Memoranda of Understanding (MoU) to facilitate the coordination process: one MoU involves the administrations providing MSS over North America and a second MoU involves administrations providing MSS over ITU Regions 1 and 3. Usually on an annual basis under these MoUs, Operator Review Meetings (ORM) coordinate and review assignments across the bands 1 525-1 559/1 626.5-1 660.5 MHz so as to ensure fair and efficient use of the radio spectrum.

This multilateral process recognizes the communications needs of AMS(R)S and the resulting spectrum needed to accommodate the requirements of the systems offering this service, in accordance with the Radio Regulatory provisions. The current coordination process includes a validation process of requested spectrum assignments in order to justify the spectrum requirements and achieve efficient use of the spectrum. By adopting the MoUs, administrations have increased the efficiency of the coordination process. Additional coordination also takes place outside of the MoU process, where necessary.

WRC-12 is invited to consider the results of ITU-R studies and to take appropriate action on this subject, while retaining unchanged the generic allocation to the mobile-satellite service in the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz.

PROPOSALS:

NOC USA/1.7/1

ARTICLE 5

Frequency allocations

Section IV – Table of Frequency Allocations
(See No. 2.1)

Reasons: The current allocations to AMS(R)S pursuant to No 5.357A are sufficient to accommodate long term AMS(R)S spectrum requirements.

MOD USA/1.7/2

5.357A In applying the procedures of Section II of Article **9** to the mobile-satellite service in the bands 1 545-1 555 MHz and 1 646.5-1 656.5 MHz, priority shall be given to accommodating the spectrum requirements of the aeronautical mobile-satellite (R) service providing transmission of messages with priority 1 to 6 in Article **44**. Aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article **44** shall have priority access and immediate availability, by pre-emption if necessary, over all other mobile-satellite communications operating within a network. Mobile-satellite systems shall not cause unacceptable interference to, or claim protection from, aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article **44**. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services. (The provisions of Resolution **222 (WRC-20<u>12</u>~~00~~)**~~*~~ shall apply.) (WRC-20<u>12</u>~~00~~)

~~* *Note by the Secretariat:* This Resolution was revised by WRC-07.~~

Reasons: Consequential to the proposed MOD to Resolution **222**

<u>NOC</u> USA/1.7/3

5.362A

Reasons: For the bands covered by agenda item 1.7, the 1 555-1 559 MHz and 1 656.5-1 660.5 MHz bands with the 2 x 10 MHz in No. **5.357A** are sufficient to accommodate AMS(R)S operations inside the United States. No additional spectrum is required to satisfy this agenda item.

NOC USA/1.7/4

ARTICLE 9

Procedure for effecting coordination with or obtaining agreement of other administrations[1, 2, 3, 4, 5, 6, 7, 8] (WRC-07)

Reasons: No changes to Article 9 are needed for Agenda Item 1.7. The Modified Resolution 222 (WRC-2012) provides adequate provisions to address the accommodation of the long term AMS(R)S requirements pursuant to RR 5.357A.

MOD USA/ 1.7/5

RESOLUTION 222 (Rev.WRC-~~07~~12)

Use of the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz by the mobile-satellite service, and ~~studies~~ procedures to ensure long-term spectrum ~~availability~~ access for the aeronautical mobile-satellite (R) service

The World Radiocommunication Conference (Geneva, 2012~~2007~~),

considering

a) that prior to WRC-97, the bands 1 530-1 544 MHz (space-to-Earth) and 1 626.5-1 645.5 MHz (Earth-to-space) were allocated to the maritime mobile-satellite service and the bands 1 545-1 555 MHz (space-to-Earth) and 1 646.5-1 656.5 MHz (Earth-to-space) were allocated on an exclusive basis to the aeronautical mobile-satellite (R) service (AMS(R)S) in most countries;

b) that WRC-97 allocated the bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space) to the mobile-satellite service (MSS) to facilitate the assignment of spectrum to multiple MSS systems in a flexible and efficient manner;

c) that WRC-97 adopted No. **5.353A** giving priority to accommodating spectrum requirements for and protecting from unacceptable interference distress, urgency and safety communications of the Global Maritime Distress and Safety System (GMDSS) in the bands 1 530-1 544 MHz and 1 626.5-1 645.5 MHz and No. **5.357A** giving priority to accommodating spectrum requirements for and protecting from unacceptable interference the AMS(R)S providing transmission of messages with priority categories 1 to 6 in Article **44** in the bands 1 545-1 555 MHz and 1 646.5-1 656.5 MHz;

d) that AMS(R)S is an essential element of ICAO CNS/ATM to provide safety and regularity of flight in the civil air transportation,

further considering

a) that coordination between satellite networks is required on a bilateral basis in accordance with the Radio Regulations, and, in the bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space), coordination is partially assisted by regional multilateral meetings;

b) that, in these bands, geostationary mobile-satellite system operators currently use a capacity-planning approach at multilateral coordination meetings, with the guidance and support of their administrations, to periodically coordinate access to the spectrum needed to accommodate their requirements;

c) that spectrum requirements for MSS networks, including the GMDSS and AMS(R)S, are currently accommodated through the capacity-planning approach and that, in the bands to which Nos. **5.353A** or **5.357A** apply, this approach, and other methods may assist in accommodating the expected increase of spectrum requirements for GMDSS and AMS(R)S;

d) that Report ITU-R M.2073 has concluded that prioritization and inter-system pre-emption between different mobile-satellite systems is not practical and, without a significant advance in technology, is unlikely to be feasible for technical, operational and economical reasons. ~~*It summarized that prioritization and intersystem real-time pre-emption would not necessarily increase the efficiency of spectrum use compared to the current situation, but it would certainly complicate substantially the coordination process and network structure*~~;

e) that there is existing and increasing demand for spectrum for AMS(R)S and non-AMS(R)S by several mobile satellite systems in the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz~~, and that the application of this Resolution may impact the provision of services by non-AMS(R)S systems in the mobile satellite service~~;

f) that future requirements for ~~AMS(R)S and~~ GMDSS spectrum may require additional allocations,

recognizing

a) that absolute priority to all telecommunications concerning safety of life at sea, on land, in air or in outer space is given by No. 191 of the ITU Constitution;

b) that the International Civil Aviation Organization (ICAO) has adopted Standards and Recommended Practices (SARPs) addressing satellite communications with aircraft in accordance with the Convention on International Civil Aviation;

c) that all air traffic communications as defined in Annex 10 to the Convention on International Civil Aviation fall within priority categories 1 to 6 of Article **44**;

d) that Table 15-2 of Appendix **15** identifies the bands 1 530-1 544 MHz (space-to-Earth) and 1 626.5-1 645.5 MHz (Earth-to-space) for distress and safety purposes in the maritime mobile-satellite service as well as for routine non-safety purposes,

e) that any administration having difficulty in applying the procedures of Articles **9** and **11** with respect to No. **5.357A** and this Resolution may at any time request assistance of the Radiocommunication Bureau and the Board under the relevant provisions of the Radio Regulations, including Article **7**, the relevant provisions of Articles **9** and **11**, as well as Articles **13** and **14**,

noting

that, since spectrum resources are limited, there is a need to use them in the most efficient manner within and amongst various MSS systems,

resolves

1 that, in frequency coordination of MSS in the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz, the notifying administrations of mobile-satellite networks shall ensure that the spectrum needed for distress, urgency and safety communications of GMDSS, as elaborated in Articles **32** and **33**, in the bands where No. **5.353A** applies, and for AMS(R)S communications within priority categories 1 to 6 of Article **44** in the bands where No. **5.357A** applies, is ~~accommodated~~ met;

2 that the notifying administrations of mobile-satellite networks shall ensure the use of the latest technical advances in mobile-satellite systems, in order to achieve the most flexible, efficient and practical use of the generic MSS allocations;

3 that the notifying administrations of mobile-satellite networks shall ensure that, if spectrum requirements of an MSS, including AMS(R)S, network is decreasing relative to the previous coordination meeting, the corresponding unused spectrum resources shall be released to facilitate efficient use of spectrum;

~~3~~4 that the notifying administrations of mobile-satellite networks shall ensure that MSS operators carrying non-safety-related traffic yield capacity, as and when necessary, to accommodate the spectrum requirements for distress, urgency and safety communication of GMDSS communications, as elaborated in Articles 32 and 33, and for AMS(R)S communications within priority categories 1 to 6 of Article 44; *this* could be achieved in advance through the coordination process in *resolves 1* and the procedures contained in the Annex to this Resolution shall apply. ~~and, when necessary, through other means if such means are identified as a result of studies in~~

~~*invites ITU-R,*~~

~~to conduct, in time for consideration by WRC-11, the appropriate technical, operational and regulatory studies to ensure long-term spectrum availability for the aeronautical mobile-satellite (R) service (AMS(R)S) including:~~

~~i) to study, as a matter of urgency, the existing and future spectrum requirements of the aeronautical mobile-satellite (R) service;~~

~~ii) to assess whether the long-term requirements of the AMS(R)S can be met within the existing allocations with respect to No. **5.357A** while retaining unchanged the generic allocation for the mobile-satellite service in the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz, and without placing undue constraints on the existing systems operating in accordance with the Radio Regulations;~~

~~iii) to complete studies to determine the feasibility and practicality of technical or regulatory means, other than the coordination process referred to in *resolves* 1 or the means considered in Report ITU-R M.2073, in order to ensure adequate access to spectrum to accommodate the AMS(R)S requirements as referenced in *resolves* 3 above, while taking into account the latest technical advances in order to maximize spectral efficiency;~~

~~iv) if the assessment identified in *invites ITU-R* i) and ii) indicates that these requirements cannot be met, to study existing MSS allocations or possible new allocations only for satisfying the requirements of the aeronautical mobile satellite (R) service for communications with priority categories 1 to 6 of Article 44, for global and seamless operation of civil aviation taking into account the need to avoid undue constraints on existing systems and other services,~~

~~invites WRC-11~~

~~to consider the results of the above ITU-R studies and to take appropriate action on this subject, while retaining unchanged the generic allocation to the mobile-satellite service in the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz,~~

~~*invites*~~

~~the International Civil Aviation Organization (ICAO), the International Maritime Organization (IMO), the International Air Transport Association (IATA), administrations and other organizations concerned to participate in the studies identified in *invites ITU-R* above.~~

ANNEX

Procedures to implement No. 5.357A and Resolution 222 (Rev. WRC-12) to address AMS(R)S Spectrum Requirements

1) The notifying administrations of planned MSS, including AMS(R)S, networks shall submit the required technical characteristics and other relevant information of their MSS networks in accordance with Appendix **4**. Coordination of these MSS systems with other affected satellite systems operating in the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz shall proceed in accordance with Articles **9** and **11** and other relevant provisions of the Radio Regulations, as appropriate.

2) To further facilitate coordination under Articles **9** and **11**, the notifying administrations of MSS, including AMS(R)S, networks may authorize their respective MSS satellite operators, including AMS(R)S satellite operators, to enter into bilateral and multilateral coordination processes to secure operator agreements on access to spectrum for their satellite systems.

3) At frequency coordination meetings, including operator meetings referred to in 2), the notifying administration or its respective MSS satellite operator shall present the spectrum requirements of each AMS(R)S system developed in accordance with an agreed methodology and accompanied with the information justifying such requirements. The other notifying administrations or their respective MSS satellite operators then validate the requirements under agreed criteria. The notifying administrations and/or their MSS operators shall accommodate validated AMS(R)S spectrum requirements in accordance with priority categories 1 to 6 of Article **44**. In the event that spectrum requirements of an MSS, including AMS(R)S, network is decreasing relative to the previous coordination meeting, the notifying administration of the MSS network shall release the corresponding unused spectrum resources.

4) The notifying administrations of MSS systems, including AMS(R)S, have responsibility to ensure that their respective assignments are compatible in the relevant bilateral or multilateral frequency coordination meetings (in particular when those systems span over various geographic area(s)). In the event an administration notifying an AMS(R)S system experiences difficulty in accommodating its validated AMS(R)S spectrum requirements at these meetings, it should invoke No. **5.357A** (as per the procedures described in Items 5, 6 and 7 below).

5) In the event that a notifying AMS(R)S administration invokes No. **5.357A** based on the results of a bilateral or multilateral coordination operators' meeting, that administration shall ensure that its designated operator does not accept the spectrum sharing arrangement developed at the operators' meeting, as acceptance indicates that the agreement satisfies requirements presented. That AMS(R)S administration shall inform the other administrations involved in the coordination process of its intention to invoke No. **5.357A**, with a copy to the Bureau. The concerned AMS(R)S administration then calls for an administrations' frequency coordination meeting of all affected notifying administrations, which should be convened within six months. That notifying AMS(R)S administration shall seek the assistance of the Radiocommunication Bureau in accordance with Articles **7** and **13,** if any of the affected notifying administrations do not agree to meet to resolve the raised issues.

6) At the administrations' frequency coordination meeting, all affected notifying administrations shall review and validate the AMS(R)S requirements of the notifying administration referred to in 5)

above. All affected notifying administrations shall cooperate toward accommodating any validated AMS(R)S requirements in accordance with No. **5.357A** and Resolution **222 (Rev.WRC-12)**. In this regard, notifying administrations shall ensure that MSS operators carrying non safety-related traffic yield capacity, as and when necessary, to accommodate the spectrum requirements for AMS(R)S communications with priority categories 1 to 6 of Article **44**.

7) If the matter remains unresolved at the administrations' frequency coordination meeting referred to in 6) above, the notifying AMS(R)S administration shall seek the assistance of the Radiocommunication Bureau pursuant to Articles **7** and **13** and notify the respective administrations indicating that its AMS(R)S requirements have not been satisfied. The Radiocommunication Bureau shall provide a report and assistance in accordance with No. **13.3**.

8) To facilitate the users' long term planning, each MSS operator providing AMS(R)S service or its notifying administration may decide to disclose information regarding its coordinated AMS(R)S spectrum resource (e.g. to AMS(R)S users of such service).

Reasons: It is necessary to explicitly identify the coordination process that should be used, highlighting the regulatory provisions in place describing administrations' rights and obligations when seeking priority access to AMS(R)S spectrum as well as the process to be followed when validated AMS(R)S spectrum needs of a system are not fulfilled.

ADD USA/1.7/6

RESOLUTION [SPECT.METHOD] (WRC-12)

Methodology to determine AMS(R)S Spectrum Requirements within the bands 1 545-1 555 MHz (space-to-Earth) and 1 646.5-1 656.5 MHz (Earth-to-space)

The World Radiocommunication Conference (Geneva, 2012),

Considering

a) that coordination between satellite networks is required on a bilateral basis in accordance with the Radio Regulations, and, in the bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space), coordination is partially assisted by regional multilateral meetings;

b) that, in these bands, geostationary mobile-satellite system operators currently use a capacity-planning approach at multilateral coordination meetings, with the guidance and support of their administrations, to periodically coordinate access to the spectrum needed to accommodate their requirements, including AMS(R)S spectrum requirements;

c) that spectrum requirements for MSS networks, including the AMS(R)S, are currently accommodated through the capacity-planning approach in the bands to which No. 5.357A applies;

d) that within the ITU-R there is no agreed methodology for computing AMS(R)S spectrum requirements;

e) that within the ITU-R, some administrations have expressed a desire to develop an agreed methodology for computing AMS(R)S spectrum requirements on an ongoing basis for purposes of bilateral and multilateral MSS coordinations conducted pursuant to Article 9 of the Radio Regulations;

f) that, since spectrum resources are limited, there is a need to use them in the most efficient manner within and amongst various MSS systems,

recognizing

a) that WRC-97 allocated the bands 1 525-1 559 MHz (space-to-Earth) and 1 626.5-1 660.5 MHz (Earth-to-space) to the mobile-satellite service (MSS) to facilitate the assignment of spectrum to multiple MSS systems in a flexible and efficient manner;

b) that WRC-97 adopted No. 5.357A giving priority to accommodating spectrum requirements for and protecting from unacceptable interference the AMS(R)S providing transmission of messages with priority categories 1 to 6 in Article 44 in the bands 1 545-1 555 MHz and 1 646.5-1 656.5 MHz,

noting

that AMS(R)S is an essential element of ICAO CNS/ATM to provide safety and regularity of flight in the civil air transportation,

resolves

to invite the ITU-R to conduct studies on and develop in one or more ITU-R Recommendations a methodology to compute spectrum requirements for AMS(R)S related to the categories 1 to 6 of Article **44** and to take into account *considering c* in conducting these studies.

Reasons: To have the ITU-R conduct studies on and develop in one or more ITU Recommendations, a methodology to compute the spectrum requirements for AMS(R)S related to categories 1 to 6 of Article 44 to assist notifying MSS and AMS(R)S administrations in satellite coordination in their efforts to satisfy AMS(R)S requirements in the bands 1545-1555MHz and 1646.5- 1656.6 MHz pursuant to Mod Resolution 222(WRC-12)

Regulatory Issues

DOCUMENT WAC/102(26.10.10)

IWG-4 Recommendations Regarding Proposals on Integrated MSS Systems in L-Band Agenda Items 7, 4, and 8.2

IWG-4 has discussed the topic of Integrated Systems since its March 2009 meeting. Unfortunately, it was not possible to achieve consensus despite several attempts to address this matter under different agenda items of WRC-12.

The alternative recommendations are presented in the two Annexes to this document.

Annex A includes a set of three draft proposals submitted and supported by LightSquared. These draft proposals refer to agenda items 7, 4 and 8.2 and can be found in Attachments A, B and C to Annex A, respectively.

Annex B contains the recommendations submitted and supported by Inmarsat with respect to LightSquared's proposal. An alternative path is also offered in Annex B.

ANNEX A

Overview: LightSquared's Recommended Draft Proposals for WRC-12 Integrated MSS Systems

BACKGROUND:
Integrated MSS Systems[1] use technology to integrate mobile-satellite and terrestrial components within a single system, will operate in the 1525- 1559 MHz and 1626.5-1660.5 MHz bands and will begin operations including deploying Complementary Ground Component (CGC) networks in 2011. Recent FCC decisions have stated that this band and the deployment of CGC is an essential element in the U.S. Administration's initiative to make additional spectrum available for mobile broadband deployment[2].
Currently, the Radio Regulations do not have regulatory and technical provisions to address the unique architectural and operational aspects of the Complementary Ground Component ("CGC") of Integrated MSS Systems. Consequently, it is essential that at the first opportunity, a World Radiocommunication Conference adopt provisions to associate CGC with MSS networks in the bands 1525-1559 MHz and 1626.5-1660.5MHz and also the conditions under which CGC networks will be permitted. Further, because the CGC is a terrestrial deployment that must be authorized by individual administrations, it is imperative to have a harmonized framework for global CGC deployment. Thus, until a future WRC is able to address the allocation status of CGC within Integrated MSS Systems, it is necessary to adopt interim procedures for use by individual administrations for the ITU notification of CGC networks of Integrated MSS networks.
PROPOSALS:
Considering the imminent deployment of Integrated MSS systems, three proposals have been drafted for WAC recommendation to the FCC as U.S. Proposals for WRC-12. These proposals are:

1) Under Agenda Item 4 to modify Recommendation 206 to indicate that Integrated MSS systems are being implemented in the 1525-1559 MHz and 1626.5-1660.5 MHz bands, to define, on an interim basis, MSS as including Integrated MSS systems with CGC in these frequency bands and to urge administrations to include CGC in MSS satellite coordination discussions;
2) Under Agenda Item 7, to provide a Resolution [CGC.Notify] with interim procedures for the notification of Complementary Ground Components of Integrated MSS Systems in the 1525-1544 MHz, 1545-1559 MHz, 1626.5- 1645.5 MHz and 1646.5-1660.5 MHz bands,

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[1] The ITU-R Coordination Committee for Vocabulary ("CCV") is considering the definition of Integrated MSS System given below. This is also the working definition used in ITU-R Working Parties 4C, 4B, and 4A. *See, SUMMARY RECORD OF THE CCV/1-10 MEETING OF THE COORDINATION COMMITTEEFOR VOCABULARY (CCV),* Document CCV/29, 22 March 2010 (Geneva). Within the ITU-R, the working definition for Integrated MSS Systems is:

> An integrated MSS system is a system employing a satellite component and ground component where the ground component is complementary to the satellite component and operates as and is an integral part of the MSS system. In such systems the ground component is controlled by the satellite resource and network management system. Further, the ground component uses the same portions of MSS frequency bands as the associated operational mobile-satellite system.

[2] In the matter of Fixed and Mobile Services in the Mobile Satellite Service Bands at 1525-1559 MHz and 1626.5-1660.5 MHz, 1610-1626.5 MHz and 2483.5-2500 MHz, and 2000-2020 MHz and 2180-2200 MHz, ET Docket No. 10-142, Notice of Proposed Rulemaking and Notice of Inquiry, released July15, 2010, footnote 29.

and

3) Under Agenda Item 8.2 to propose a WRC-16 Agenda item and an accompanying Resolution [CGC Agenda (WRC-12)] "to consider adopting regulatory, technical and allocation provisions in the Radio Regulations to enable the Complementary Ground Component ("CGC") of a mobile-satellite service (MSS) system to operate on a co- primary basis with the MSS allocation in the bands 1525-1544, 1545 -1559 MHz., 1626.5- 1645.5 MHz and 1646.5- 1660.5 MHz.

The three proposals build upon one another and, thus, are interdependent as described below.

The Mod Recommendation 206 proposal defines, on an interim basis, MSS in the bands 1525-1544 MHz, 1545-1559 MHz, 1626.5- 1645.5 MHz and 1646.5-1660.5 MHz as including CGC within Integrated MSS System networks. This will recognize that CGC is operating in the bands with the MSS links of the host Integrated MSS System. It urges administrations to include CGC in their MSS satellite coordination discussions

The Resolution [CGC. Notify] proposal creates a mechanism for the CGC networks being implemented by the notifying administration of the Integrated MSS System network and other Administrations implementing CGC to associate the CGC networks with the Integrated MSS network. It provides interim procedures, prior to action at WRC-16, that would permit the notifying administration to inform the ITU – BR and other administrations that the notified MSS network is an Integrated MSS System network, and to confirm that associated CGC networks that may be implemented by other administrations would operate within the parameters of the notified Integrated MSS System network. Resolution [CGC.Notfy] would be made applicable only to the MSS in the 1525-1544MHz and 1555- 1559 MHZ and 1626.5 -1645.5 MHz and 1646.5-1660.5 MHz bands

Finally, the third proposal is for a WRC-16 Agenda item with an attendant Resolution [CGC.Agenda (WRC-12)] that addresses all of the regulatory, technical and operational issues that are to be studied in the intervening period between WRC-12 and WRC-16 for WRC-16 consideration in addressing the appropriate allocation mechanism and structure to support CGC networks operating in an Integrated MSS network on a primary basis.

The three proposals are interdependent and are needed to provide through Mod Recommendation 206 and Resolution [CGC.Notify], an interim regulatory structure within the context of the Radio Regulations that will recognize CGC deployments and operations within Integrated MSS System networks until WRC-16 considers, through Resolution [CGC.Agenda], appropriate regulatory and operational modifications to the Radio Regulations to accommodate deployment and operation of CGC on a permanent basis.

The three Draft proposals are attached and are recommended for adoption by the FCC's WRC Advisory Committee as recommended draft U.S. proposals.

ATTACHMENT A

United States of America
DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 7: *To consider possible changes in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference: "advance publication, coordination, notification and recording procedures of the Radio Regulations for frequency assignments pertaining to space services,"[3] in accordance with Resolution 86 (Rev. WRC 07).*

Background: Integrated MSS Systems[4] employ technology that integrates mobile- satellite components and terrestrial components ("complementary ground component or 'CGC'") into a single system reusing MSS frequencies for both components. Currently, there are provisions in the Radio Regulations to accommodate satellite systems and terrestrial networks separately, but additional provisions are needed to accommodate the unique aspects of Integrated MSS Systems.
Resolution 86 resolves to invite future world radiocommunication conferences to:

1) *to consider any proposals which deal with deficiencies and improvements in the advance publication, coordination, notification and recording procedures of the Radio Regulations for frequency assignments pertaining to space services which have been identified by administrations as appropriate, and 2) to ensure that these procedures and the related appendices of the Radio Regulations reflect the latest technologies as far as possible.*[5]

Discussion: Currently, the Radio Regulations lack certain regulatory provisions for notifying and registering the complementary ground component ("CGC") of Integrated MSS Systems. Because the architectural and operational features of Integrated MSS Systems are such that the MSS component and terrestrial component are integrated within a single network, it is essential to recognize and give consideration to both elements of these networks. In the bands 1525-1544 MHz, 1545-1559 MHz, 1626.5- 1645.5 MHz and 1646.5- 1660.5 MHz , at least one MSS operator will roll out CGC deployments in 2011.
Consequently, it would be prudent to provide, at least on an interim basis as a minimum, procedures in the Radio Regulations to take account of CGC deployment in the bands 525-1544 MHz, 1545-1559 MHz, 1626.5- 1645.5 MHz and 1646.5-1660.5 MHz. Therefore, interim procedures are proposed in New Resolution [CGC.Notify] to provide a mechanism for notifying and registering CGC stations, and for submitting to the ITU BR and subsequently entering information for the notification of CGC stations and for associating CGC assignments with their operational MSS systems within the bands referenced above. Additionally, Resolution [CGC. Notify] instructs the ITU Radiocommunication Bureau on procedures for handling such CGC information submitted in accordance with interim procedures provided in Resolution [CGC.Notify]. Resolution [CGC.Notify] will supplement the current Article 9 and Article 11 procedures that are applicable to the satellite component of Integrated MSS Systems.

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[3] Int'l Telecomm. Union [ITU], *Implementation of Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference*, at *resolves to invite future world radiocommunication conferences* ¶ 1, Resolution 86 (Rev. WRC-07) (2007).

[4] The ITU-R Coordination Committee for Vocabulary ("CCV") is considering the definition of Integrated MSS System given below. This is also the working definition used in ITU-R Working Parties 4C, 4B, and 4A. *See, SUMMARY RECORD OF THE CCV/1-10 MEETING OF THE COORDINATION COMMITTEE FOR VOCABULARY (CCV),* Document CCV/29, 22 March 2010 (Geneva).

[5] *Supra* note 1, *resolves to invite future world radiocommunication conferences* ¶¶ 1-2.

USA/ /02 ADD

Resolution [CGC.Notify] (WRC-2012)

Interim Procedures for Notification and Recording of the Complementary Ground Component of Integrated MSS Systems[6] in 1525-1544 MHz, 1545-1559 MHz, 1626.5- 1645.5 MHz and 1646.5-1660.5 MHz

The World Radiocommunication Conference (Geneva, 2012),

considering

a) that MSS systems can provide service over a wide geographic area and are particularly suited for emergency and disaster recovery communications and rural communications;
b) that MSS systems can have limited capacity for providing radio communications services in urban areas due to natural and/or man-made blockage;
c) that an MSS system with an integrated Complementary Ground Component (CGC) system will extend and improve the availability of radio communications services in areas where reliable current and next generation communications are not otherwise provided with one or more space stations or cannot otherwise be assured, and in this way increase spectrum efficiency in bands allocated to the mobile-satellite service;
d) that a number of administrations are implementing or planning to implement Integrated MSS Systems in parts of the bands identified for the satellite component of IMT in the bands 1525- 1559 MHz and 1626.5- 1660.5 MHz;
e) that in providing radiocommunication services, there is a need continually to exploit technological developments to increase the efficiency of use of finite radiocommunication spectrum resources as technology permits.

recognizing
a) that the bands 1525-1544 MHz, 1545-1559 MHz, 1626.5-1645.5 MHz and 1646.5-1660.5 MHz are allocated on a co-primary basis to the mobile-satellite service and to other services;
b) that Resolution **215 (Rev.WRC-97)** addresses the coordination process among mobile-satellite systems and the efficient use of the allocations to the mobile –satellite service in the 1- 3 GHz range;
c) that the distress, urgency and safety communications of the Global Maritime Distress and Safety System and the aeronautical mobile-satellite (R) service have priority access and immediate availability in specified bands over all other mobile-satellite service communications in accordance with Nos. 5.353A and 5.357A;
d) that the frequency bands referred to in *recognizing a)* are also used by other systems in the services to which the bands are allocated, and that these systems and services need to be protected from harmful interference;
e) that the deployment of the Complementary Ground Component is predicated upon the Complementary Ground Component being integrated with one or more space stations of an Integrated MSS System;

[6] An Integrated MSS System is a system employing a satellite component and ground component where the ground component is complementary to the satellite component and operates as and is an integral part of the MSS system. In such systems the ground component is controlled by the satellite resource and network management systems. Further, the ground component uses the same portions of MSS frequency bands as the associated operational mobile-satellite system.

f) that the Complementary Ground Component will use the same allocated and assigned frequency bands as the associated MSS system;

g) that the Complementary Ground Component will be located only within the service area of its associated MSS system and is to be controlled by the Integrated MSS System network management system;

noting

a) that, in general, co-frequency sharing and reuse of the spectrum by independently controlled mobile-satellite and terrestrial mobile systems is not feasible in the same geographic area;

b) that Integrated MSS Systems can avoid the spectrum-sharing compatibilities in *noting* 1);

c) that Article 11 provisions No 11.2 through 11.11 requires that " Any frequency assignment to a transmitter station and to its associated receiving station shall be notified to the Bureau";

d) that the coordination and notification procedures of Articles 9 and 11 apply to the MSS component of Integrated MSS Systems;

e) that currently Appendix 4 of the Radio Regulations does not contain provisions for associating notified Complementary Ground Component stations with MSS components of their Integrated MSS system;

f) that the mobile terminals (consisting of mobile earth stations and mobile stations in the same platform) of such Integrated MSS Systems are capable of communicating directly via multiple radio interfaces with the base stations of the Complementary Ground Component and the space stations of the associated mobile satellite system using the same common frequency bands;

resolves

1. that administrations choosing to associate CGC operations with Integrated MSS network frequency assignments shall apply the attached Annex to the Complementary Ground Component of Integrated MSS systems as described in the *recognizings.*

instructs the Radiocommunication Bureau

1. to implement the interim procedures of the attached Annex for base stations transmitting in the bands 1 525 - 1544 MHz, and 1 545 - 1 559 MHz, and mobile stations transmitting in the bands 1626.5 - 1645.5 MHz ,and 1646.5 - 1660.5 MHz that are integrated with MSS systems operating in the same frequency bands and in territories within the MSS system service area provided that coordination or notification information has been submitted for the associated MSS system in accordance with Article 9 or Article 11;

ANNEX

Interim Procedures for Notification and Recording of Complementary Ground Components of Integrated MSS Systems

Introduction

This Annex provides interim procedures for the submission of technical information to the ITU Radiocommunications Bureau (BR) for the Complementary Ground Components of Integrated MSS networks in the 1525-1544 MHz, 1545-1559 MHz, 1626.5- 1645.5 MHz and 1646.5 – 1660.5MHz bands. These interim procedures provide information that is to be submitted by the Notifying Administration of the Integrated MSS system and by Administrations implementing the Complementary Ground Component of the Integrated MSS system.

Interim Procedure

A) Administrations that are implementing a Complementary Ground Component of an Integrated MSS system shall submit the following information to the ITU-BR in accordance with these procedures: An Appendix 4 Annex 1 notice for stations of a Complementary Ground Component;

1. in the remarks of the Appendix 4 Annex 1 notice,

   a. indicate that the stations are Complementary Ground Components of an Integrated MSS System submitted in accordance with these procedures, and

   b. specify the associated MSS system and related ITU IFIC and Network Identifier.

B) The Notifying Administration for an MSS system of an Integrated MSS system shall submit an Appendix 4 Annex 2 notice and:

1. shall indicate in the submittal letter for the Appendix 4 Annex 2 notice that the MSS network is an Integrated MSS network;
2. shall provide a cross reference to the Appendix 4 Annex 1 filing which has the characteristics of stations of the Complementary Ground Component; and
3. shall confirm separately any Appendix 4 Annex 1 notice that is submitted by another Administration implementing a Complementary Ground Component that is associated with the Integrated MSS system.

C) Administrations notifying Integrated MSS systems shall include reference to the Appendix 4 Annex 1 notice of the associated Complementary Ground Component of an Integrated MSS system in the Article 11 notification.

The ITU Radiocommunications Bureau shall:

1. process complete notices for Complementary Ground Component base stations transmitting in the bands 1 525 - 1544 MHz, and 1 545 - 1 559 MHz, and mobile stations transmitting in the bands 1626.5 - 1645.5 MHz, and 1646.5 - 1660.5 MHz that are integrated with MSS systems operating in the same frequency bands and in territories within the MSS system service area provided that coordination or notification information has been submitted for the associated MSS system in accordance with Article 9 or Article 11;

2. where possible, include the reference to the Appendix 4, Annex 1 Complementary Ground Component notice with the publication of the Appendix 4 Annex 2 information for the MSS system of the Integrated MSS system;

3. record such CGC stations as integrated with MSS systems on the basis of:

a. a statement by an Administration submitting Complementary Ground Component notices in accordance with this interim procedure identifying the MSS system with which the Complementary Ground Component is integrated; and

b. a confirmation of the above statement by the Administration notifying the Integrated MSS System;

4. record such CGC station notices, in accordance with the Radio Regulations, as appropriate, together with the identification of the associated MSS system, concurrently with, or after assignments are recorded for the associated MSS system in the Integrated MSS System; and

5. if the MSS space station assignment is cancelled or suppressed, the Bureau shall review the earth station and CGC station(s) associated with the MSS space station and request the Notifying administration of the earth stations or the CGC stations to either cancel or suitably modify the basic characteristics of the entry.

Reason: *To provide interim notification and recording procedures for the Complementary Ground Component of Integrated MSS Systems by providing a Resolution [CGC.Notify] with interim procedures for filing notices of stations of the Complementary Ground Component of Integrated MSS Systems and to identify the relevant associated mobile satellite network for the Complementary Ground Component. The interim procedures provided in Resolution [CGC.Notify] include procedures for the ITU Radiocommunication Bureau for handling such CGC information submitted by its notifying administration. This Resolution [CGC.Notify] will supplement the current Article 9 and Article 11 procedures that are applicable to the satellite component of Integrated MSS Systems.*

ATTACHMENT B

United States of America
DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 4: ***i****n accordance with Resolution 95 (Rev.WRC 07), to review the resolutions and recommendations of previous conferences with a view to their possible revision, replacement or abrogation;*
Background: Integrated MSS Systems[7] employ technology that integrates mobile-satellite components and terrestrial components ("complementary ground component or 'CGC'") into a single system reusing MSS frequencies for both components. Currently, there are provisions in the Radio Regulations to accommodate satellite systems and terrestrial networks separately, but additional provisions are needed to accommodate the unique aspects of Integrated MSS Systems.

Recommendation 206 (WRC-07) recognized that some administrations are implementing Integrated MSS Systems. This is, or will be, occurring on both a regional and global basis beginning as early as 2011. Recommendation 206 (WRC-07) invited the ITU-R to perform studies on sharing, technical and regulatory issues regarding these Integrated Systems. Since WRC-07, in accordance with Recommendation 206 (WRC-07), a number of studies related to Integrated MSS Systems have been initiated in ITU-R Working Parties 4B and 4C. Importantly, at least one Integrated MSS System authorized to operate in the bands 1525-1559 and 1626.5-1660.5 MHz will begin deployment of CGC networks in 2011.

Discussion: With the imminent deployment of full Integrated MSS Systems in the 1525-1559 and 1626.5-1660.5 MHz bands, and because specific provisions for the complementary ground component of an Integrated MSS System are needed in the current Radio Regulations,[8] it is imperative that on an interim basis as a minimum, provisions are adopted into the Radio Regulations at WRC-12 to provide regulatory guidance for the treatment of Integrated MSS Systems, pending the completion of ITU-R studies, and consideration of Integrated MSS System matters at the next WRC. This will provide regulatory certainty and guidance for administrations to permit CGC deployment in their territories. This will ease rollout of service as well as promote more efficient use of spectrum and will facilitate interference control and protection.

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[7] The ITU-R Coordination Committee for Vocabulary ("CCV") is considering the definition of Integrated MSS System given below. This is also the working definition used in ITU-R Working Parties 4C, 4B, and 4A. *See, SUMMARY RECORD OF THE CCV/1-10 MEETING OF THE COORDINATION COMMITTEEFOR VOCABULARY (CCV),* Document CCV/29, 22 March 2010 (Geneva).

[8] Other organizations have recognized the lack of Radio Regulation provisions to cover the case of Integrated Systems. For example, in Europe, the CEPT Conference Preparatory Group Project Team A (CPG-PTA) has taken a preliminary position that the existing radio regulations need additional provisions for regulatory provisions for full deployment of MSS systems with CGC because of the absence of procedures for CGC notification, registration and coordination to facilitate the full deployment of MSS systems with CGC . (*See* Conference of European Postal and Telecommunications Administrations [CEPT], *Working Document Agenda Item 1.2*, at 11, CPG-PTA Temp 03.) Furthermore, the CPG-PTA indicates that the most appropriate option is to introduce a new definition for the service combining features of mobile service and mobile satellite service to enable the introduction of CGC, for example an "Integrated Satellite service." (*Id.* at 12.)

USA/ /01 MOD

RECOMMENDATION 206 (WRC-07)

~~Consideration on the possible~~ Uuse of Iintegrated Mmobile-Ssatellite Sservice and ground component systems in some frequency bands identified for the satellite component of International Mobile Telecommunications

The World Radiocommunication Conference (Geneva, 2012~~07~~),

considering

a) that mobile-satellite service (MSS) systems may provide service to a wide area;

b) that MSS systems can have a limited capacity for providing ~~reliable~~ radiocommunication services in urban areas due to~~on account of~~ natural or man-made obstacles and that the ground component of an integrated MSS system can mitigate blockage areas, as well as allow for indoor service coverage;

c) that MSS systems can improve coverage of rural areas, thus being one element that can bridge the digital divide in terms of geography;

d) that MSS systems are suitable for public protection and disaster relief communications, as stated in Resolution **646 (WRC-03)**;

e) that the bands 1 525-1 544 MHz, 1 545-1 559 MHz, 1 610-1 626.5 MHz, 1 626.5-1 645.5 MHz, 1 646.5-1 660.5 MHz and 2 483.5-2 500 MHz are among those identified in Resolution **225 (Rev.WRC-07)** for administrations wishing to implement the satellite component of International Mobile Telecommunications (IMT);

f) that the bands mentioned in *considering e)* are allocated on a primary basis to the mobile-satellite services and other services and that not all of them are allocated to the mobile service;

g) that the bands 1 980-2 010 MHz and 2 170-2 200 MHz are identified for use by the satellite component of IMT-2000 in accordance with Resolution **212 (Rev.WRC-07)**;

h) that within their territories in some or parts of the bands identified in *considering e)* and *g)* and in parts of the band 2 010-2 025 MHz in some countries in Region 2, some administrations have authorized or plan to authorize MSS system operators to establish an integrated ground component to their MSS systems ("Integrated System") and under certain conditions determined at the national level such as:

i) the ground component is complementary to, and operates as an integral part, of the MSS system and, together with the satellite component, provides an integrated service offering;

ii) the ground component is controlled by the satellite resource and network management system;

iii) the ground component uses the same designated portions of the frequency band as the associated operational MSS system;

i) that ITU-R has performed frequency sharing studies and has determined that the coexistence between independent systems in the MSS and systems in the mobile services in the same spectrum without harmful interference is not feasible in the same or adjacent geographical area,

recognizing

a) that ITU-R has not performed studies on sharing, technical or regulatory issues with regard to integrated MSS and ground component systems, but that some administrations have performed such studies;

b) that the radionavigation-satellite service in the 1 559-1 610 MHz band and the radio astronomy service in the bands 1 610.6-1 613.8 MHz and 1 660-1 670 MHz need to be protected from harmful interference;

c) that the MSS needs to be protected from harmful interference that may be caused by the introduction of the ground component of Integrated Systems;

d) that Nos. **5.353A** and **5.357A** are applicable to MSS systems in different portions of the bands 1 525-1 559 MHz and 1 626.5-1 660.5 MHz with respect to the spectrum requirements and prioritization of communications for the Global Maritime Distress and Safety System and the aeronautical mobile-satellite (R) service,

noting

a) that the combined wide-area and urban coverage capabilities of Integrated MSS Systems may contribute to meeting the particular needs of developing countries such as is noted in Resolution **212 (Rev.WRC-07)**;

b) that some administrations that are planning to implement or are implementing Integrated MSS Systems within their national territories have imposed limitations, in rules and authorization actions, on the e.i.r.p. density that the ground component of such systems may produce into bands allocated to the radionavigation-satellite service;

c) that there are a limited number of frequency bands allocated to the MSS, that these bands are already congested, and that the introduction of integrated ground components may in some instances make spectrum access for other MSS systems more difficult;

d) that administrations implementing Integrated MSS Systems may provide, in bilateral or multilateral consultations among ~~of~~ administrations, information on system characteristics of the ground component,

recommends

1. to invite ITU-R to conduct studies, as appropriate, taking into account existing systems and those proposed to be used soon and the above *considering*, *recognizing* and *noting*,

2. to invite ITU-R to conduct compatibility studies between Integrated MSS Systems and other services operating in the bands 1525-1544MHZ, 1545-1559 MHz, 1626.5-1645.5 MHz and 1646.5- 1660.5 MHz with a view to completing studies in time for RA-15

3. that on an interim basis until WRC-1~~6~~5, in the bands 1525-1544MHz , 1545-1559 MHz, 1626.5-1645.5 MHz and 1646.6-1660.5 MHz, the mobile-satellite service as defined in No 1.25 includes Integrated MSS Systems defined as:

    a. An Integrated MSS System is a system employing a satellite component and ground component where the ground component is complementary to the satellite component and operates as and is an integral part of the MSS system, In such systems the ground component is controlled by the satellite resource and network management system. Further, the ground component uses the same portions of MSS frequency bands as the associated operational mobile-satellite system.

invites administrations

1. to participate as necessary in the ITU-R studies taking into account *recognizing a)*.

2. to include within MSS satellite coordinations, conducted pursuant to No 9.11A and No 5.354, CGC stations associated with relevant MSS networks in the 1525-1544 MHz, 1545-1559 MHz,1626.5-1645.5 MHz and 1646.5-1660.5 MHz bands.

Reason: Pending action at the next WRC to provide guidance on the treatment of complementary ground component of Integrated MSS Systems, to participate as necessary in the ITU-R studies taking into account *recognizing a)*; to invite studies specifically on CGC operations in 1525-1545 MHz, 1546-1559Mhz, 1626.5-1645.5 MHz, and 1646.5-1660.5 MHz and to urge administrations to include CGC stations in relevant MSS coordinations in these bands.

ATTACHMENT C

United States of America

DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 8.2: *to recommend to the Council items for inclusion in the agenda for the next WRC, and to give its views on the preliminary agenda for the subsequent conference and on possible agenda items for future conferences, taking into account Resolution 806 (WRC 07);*

Background: At WRC-07, one Administration proposed changes to Article 5 of the Radio Regulations, as well as associated consequential changes, to provide for Integrated MSS Systems.[9] At WRC-07, discussions on this matter led to WRC-07 adopting Recommendation 206 (WRC-07).

Recommendation 206 (WRC-07) recognized that some administrations were already implementing Integrated MSS Systems, and recommended that the ITU-R conduct studies on such systems, and also invited administrations to participate in these studies. Since WRC-07, in accordance with Recommendation 206 (WRC-07), a number of studies related to Integrated MSS Systems have been initiated in ITU-R Working Party 4C and Working Party 4B. These studies are progressing and should be completed well in advance of WRC-15.

Discussion: Currently, the Radio Regulations do not have regulatory and technical provisions to address the unique regulatory and operational aspects of the complementary ground component ("CGC") of an Integrated MSS Systems. The attached proposals address this situation.

Integrated MSS Systems intended to operate in the bands 1525-1559 MHz and 1626.5- 1660.5 MHz, will begin operations, including deploying CGC networks, in 2011. It is essential that at the first opportunity a World Radiocommunication Conference adopt provisions to recognize the CGC component in the bands 1525-1559 MHz and 1626.5 – 1660.5 MHz, as well as the conditions under which such systems shall be permitted. Further, because the CGC component will be authorized by individual administrations, it is imperative to provide guidance for the notification of CGC networks to the ITU-R, as well as to provide a harmonized framework for their global deployment. The attached proposals provide a WRC-15 agenda item to address these matters, as well as an associated Resolution.

[9] The ITU-R Coordination Committee for Vocabulary ("CCV") is considering the definition of Integrated MSS System given below. This is also the working definition used in ITU-R Working Parties 4C, 4B, and 4A. *See, SUMMARY RECORD OF THE CCV/1-10 MEETING OF THE COORDINATION COMMITTEEFOR VOCABULARY (CCV),* Document CCV/29, 22 March 2010 (Geneva). Within the ITU-R, the working definition for Integrated MSS Systems is:

> An integrated MSS system is a system employing a satellite component and ground component where the ground component is complementary to the satellite component and operates as and is an integral part of the MSS system. In such systems the ground component is controlled by the satellite resource and network management system. Further, the ground component uses the same portions of MSS frequency bands as the associated operational mobile-satellite system.

Proposals:

Agenda Item 8.2

RESOLUTION 806 (WRC-07)

Preliminary agenda for the 2015 World Radiocommunication Communication Conference

USA/ /01 **ADD**

- X.X to consider adopting regulatory, technical and allocation provisions in the Radio Regulations to enable the Complementary Ground Component ("CGC") of a mobile-satellite service (MSS) system to operate on a co- primary basis with the MSS allocation in the bands 1525-1544 MHz, 1545 -1559 MHz, 1626.5- 1645.5 MHz and 1646.5- 1660.5 MHz taking into account MOD Recommendation 206 (WRC-12) and Resolution [CGC.Agenda (WRC-12)] and the results of any compatibility and sharing studies with other radio services operating in these bands.

Reason: Integrated MSS Systems are deploying in the bands 1525-1544 MHz, 1545 -1559 MHz, 1626.5-1645.5 MHz and 1646.5- 1660.5 MHz in 2011. These deployments will be both regional and global. This agenda item will allow WRC -15 to adopt regulatory, technical and allocation provisions to enable the deployment of the complementary ground component with MSS systems.

USA/ /02 **ADD**

Resolution [CGC.Agenda] [(WRC-12)]

Consideration of Regulatory, Allocation and Technical Provisions of Integrated MSS Systems[10] in the Bands 1525-1544 MHz, 1545 -1559 MHz, 1626.5- 1645.5 MHz and 1646.5- 1660.5 MHz

The World Radiocommunication Conference (Geneva, 2012),

considering

a) that mobile-satellite service (MSS) systems may provide service to a wide area;

b) that MSS systems can have limited capacity for providing radiocommunication services in urban areas due to natural or man-made obstacles;

c) that a complementary ground component of an integrated MSS system can mitigate blockage areas, as well as allow for indoor service coverage;

c) that MSS systems can improve coverage of rural areas, thus being one element that can bridge the digital divide in terms of geographical coverage;

d) that MSS systems are suitable for public protection and disaster relief communications, as stated in Resolution **646 (WRC-03)**;

e) that an MSS system with an integrated Complementary Ground Component (CGC) system will extend and improve the availability of radiocommunications services in areas where reliable current and next generation communications are not otherwise provided with one or more space stations or cannot otherwise be assured, and in this way increase spectrum efficiency in bands allocated to the Mobile-Satellite service;

f) that the bands 1 525-1 544 MHz, 1 545-1 559 MHz, and 1 626.5-1 645.5 MHz, 1 646.5-1 660.5 MHz are allocated on a co primary basis to the mobile-satellite service and other services;

[10] An Integrated MSS System is a system employing a satellite component and ground component where the ground component is complementary to the satellite component and operates as and is an integral part of the MSS system. In such systems the ground component is controlled by the satellite resource and network management systems. Further, the ground component uses the same portions of MSS frequency bands as the associated operational mobile-satellite system.

g) that within their territories in the bands identified in *considering f)*, some administrations have authorized or plan to authorize MSS system operators to establish an integrated complementary ground component to their MSS systems ("Integrated MSS System");

h) that Integrated MSS Systems meet certain conditions such as:

i) the ground component is complementary to, and operates as an integral part, of the MSS system and, together with the satellite component, provides an integrated MSS service offering;

ii) the ground component is controlled by the satellite resource and network management system;

iii) the ground component reuses the MSS frequencies of the associated mobile-satellite system;

j) that ITU-R has performed frequency sharing studies and has determined that the coexistence between independent systems in the MSS and systems in the mobile services in the same spectrum without harmful interference is not feasible in the same or adjacent geographical area;

recognizing

a) that within the ITU-R, studies are underway regarding the compatibility of the CGC element of Integrated MSS Systems with other services in the bands 1525-1544 MHz,1545 -1559 MHz, 1626.5- 1645.5 MHz and 1646.5- 1660.5MHz;

b) that some administrations have already performed such studies;

c) that in the bands 1545-1555 MHz, 1646.5- 1656.5 MHz complementary terrestrial networks are already permitted for use in conjunction with AMS(R)S systems;

d) that in providing radiocommunication services there is continuing need to exploit technological developments to increase the efficiency of use of finite radiocommunication spectrum resources as technology permits;

e) that some administrations will deploy Integrated MSS Systems beginning in 2011.

noting

a) that the combined wide-area and urban coverage capabilities of Integrated MSS Systems may contribute to meeting the particular needs of developing countries such as is noted in Resolution 212 (Rev.WRC-07);

b) that the radionavigation-satellite service in the 1 559-1 610 MHz band and the radio astronomy service in the bands 1 610.6-1 613.8 MHz and 1 660-1 670 MHz need to be protected from harmful interference;

c) that there are a limited number of frequency bands allocated to the MSS, and that Integrated MSS systems can coexist with MSS systems without CGC;

d) that on an interim basis administrations implementing Integrated MSS Systems shall, in accordance with Resolution [CGC.Notify (WRC-12)], provide to the Radiocommunications Bureau, information on system characteristics of their CGC component.

Resolves

1. that in time for consideration at the World Radiocommunication Conference -15, the ITU-R should conclude compatibility studies regarding Integrated MSS Systems and other services operating in the bands 1525- 1544 MHz,1545-1559 MHz,1626.5- 1645.5MHz and 1646.5- 1660.5 MHz.

2. that in time for consideration at the WRC-15, the ITU-R should develop necessary regulatory mechanisms to enable coordination, notification and recording in the Master International Frequency Register of the CGC of a mobile-satellite network operating in the bands 1525- 1544 MHz,1545-1559 MHz,1626.5- 1645.5MHz and 1646.5- 1660.5 MHz

3 that WRC-15 is to consider adopting regulatory, technical and allocation provisions in the Radio Regulations to enable the Complementary Ground Component ("CGC") of a mobile satellite service system to operate on co primary basis with the mobile satellite service allocation in the bands 1525- 1544

MHz,1545-1559 MHz,1626.5- 1645.5MHz and 1646.5- 1660.5 MHz taking into account MOD Recommendation 206 (WRC-12), (WRC-12) and Resolution [CGC.Agenda (WRC-12)] and the results of any compatibility and sharing studies with other radio services operating in these bands.

4 that on an interim basis, and subject to confirmation by WRC-15, in the bands 1525-1544 MHz, 1545-1559 MHz, 1626.5-1645.5 MHz and 1646.5-1660.5 MHz the mobile-satellite service as defined in No 1.25 includes Integrated MSS Systems defined as:

> An Integrated MSS System is a system employing a satellite component and ground component where the ground component is complementary to the satellite component and operates as and is an integral part of the MSS system. In such systems the ground component is controlled by the satellite resource and network management system. Further, the ground component uses the same portions of MSS frequency bands as the associated operational mobile-satellite system. ;

invites ITU-R

1 to conduct in time for WRC-15 the necessary studies leading to technical, regulatory and operational recommendations to the Conference, enabling that Conference to decide on appropriate allocations for the operation of complementary ground component of Integrated MSS systems on a co primary basis with the mobile satellite service allocation,

2 that the studies referred to in *invites ITU-R* 1 should include sharing and compatibility studies with services already having allocations in the bands 1525- 1545MHz, 1545-1559 MHz, 1626.5- 1645.5 MHz and 1646.50 1660.5 MHz;

3 to produce a report or a recommendation, as appropriate, on how to accommodate Integrated MSS systems in the bands in invites ITU-R 2,

Reason: To provide for consideration by WRC-15 of new allocations and Radio Regulations to address Integrated MSS Systems and associated Complementary Ground Components which will begin deploying in 2011.

ANNEX B

Inmarsat's Recommendation on LightSquared's Draft Proposals for WRC-12 on Integrated MSS Systems

Inmarsat's Recommendation on LightSquared's Draft Proposals for WRC-12 on Integrated MSS Systems

Inmarsat takes note of LightSquared's three proposals summarized in document IWG-4/074 (r1) for the IWG-4 for its next meeting on the following items:

1) Agenda Item 4 to modify Recommendation 206 into a Resolution [IMS 1.5/1.6 GHz (WRC-12)];

2) Agenda Item 7, to provide a Resolution [CGC.Notify]; and

3) Agenda Item 8.2 to propose a WRC-16 Agenda Item and an accompanying Resolution [CGC.Agenda (WRC-12)].

Inmarsat appreciates the intent of LightSquared's proposals. In fact, Inmarsat has cooperated with LightSquared to enable deployment of Ancillary Terrestrial Components, also known as Complementary Ground Component (ATC/CGC) base stations, including significant modifications to permit higher power operations to provide advanced mobile wireless services in North America. This process has worked well for both operators, notifying Administrations, and consumers. Inmarsat believes that the model that was used for coordination of ATC/CGC base stations in North America and other regions can serve as a framework for deployment of ATC/CGC in other regions as well.

Disadvantages of the LightSquared Proposals

In large part because the process followed in North America has worked so well, Inmarsat disagrees with the need for and desirability of proposing new ITU procedures for coordination and notification of ATC/CGC base stations. Inmarsat does not share the view that it is necessary to take the significant step of proposing to modify the ITU Radio Regulations (RRs) to accommodate ATC/CGC base stations. Inmarsat believes that the current RRs provide adequate flexibility to accommodate ATC/CGC base stations in the current ITU procedures.

Any ITU action would have to be preceded by detailed studies at the national and international levels to determine the conditions for ATC/CGC use. ITU studies would tend to be based on worst case assumptions and will delay the implementation of ATC/CGC in other countries and regions while they are pending. It is Inmarsat's belief that such studies are best carried out on a national and system specific basis to take into account actual conditions and concrete systems. Adding ITU studies to the process would create unnecessary duplication and require significant additional resources for all the necessary participants. In short, we 2

believe that it is preferable to have the introduction of ATC/CGC as an industry-driven process.

The proposed studies and implementation of additional procedures will also increase the administrative burden on the Radiocommunication Bureau (BR) as there could be many thousands of requests to notify terrestrial base stations, further taxing the BR's limited resources for processing satellite and other network filings.

Finally, as has been the case in the past, proposing and advocating for these proposed procedures nationally, regionally and at the upcoming World Radiocommunication Conference (WRC-12) will be contentious and will be enormously resource-intensive for the ITU, Administrations, and operators. Inmarsat, therefore, cannot support the proposals to include ATC/CGC into the ITU coordination process.

Alternative Path

Inmarsat believes that there is a better approach, based on the successful U.S. precedent, to achieving the goals that LightSquared is trying to obtain without the need to develop interim procedures or permanently modify the Radio Regulations and without the disadvantages of LightSquared's proposals identified above. Inmarsat submits the following alternative roadmap for consideration by the IWG-4 as a path forward for international deployment of ATC/CGC. This approach is intended to demonstrate that the goals that LightSquared is trying to achieve can be obtained more quickly and potentially result in greater flexibility with minimal impact on limited ITU and Administration resources.

There is a well-established international MSS coordination process covered by Article 9 of the RRs. It is Inmarsat's belief that that process can accommodate the goals that LightSquared is trying to achieve. Specifically, proponents of ATC/CGC networks should undertake a review of the current L-band coordination environment for each of the countries where ATC/CGC deployment is contemplated and conduct satellite coordination, if required. If satellite coordination is necessary and complete or well underway, the ATC/CGC proponents can commence discussions with other satellite operators to develop technical solutions to the coordination of ATC/CGC under existing ITU procedures.

Once agreements between the affected operators are in place, the MSS operator can approach regulators to endorse ATC/CGC operation. To facilitate this process, ATC/CGC proponents can educate regulators on already existing regulatory models in other countries, such as that in the United States. [1]

The advantage of the above approach compared to pursuing Recommendations or Resolutions at WRC-12 is that it avoids the potential development of interference rules with unnecessarily conservative or restrictive requirements. Instead, it allows for maximum deployment/operational flexibility based on operator-to-operator agreements under the

[1] *Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands, Report and Order and Notice of Proposed Rulemaking*, FCC 03-15, 18 FCC Rcd 1962 (2003), modified by Order on Reconsideration, 18 FCC Rcd 13590 (2003), reconsidered in part in *Memorandum Opinion and Order and Second Order on Reconsideration*, FCC 05-30, 20 FCC Rcd 4616 (2005), further reconsideration pending. 3

auspices of notifying Administrations. In addition, the process proposed by Inmarsat would speed deployments by avoiding years of unnecessary study and save resources for the Bureau, Member States, Sector Members and operators.

Inmarsat believes that there is a valid role for regional and ITU organizations to play in facilitating the international deployment of ATC/CGC. For example, regional and ITU organizations could facilitate sharing of information papers on ATC/CGC deployment and hold forums and workshops on the benefits of ATC/CGC and regulatory best practices. Specifically, these fora could be valuable for detailing what ATC/CGC is and how it works, the potential benefits for spectrum efficiency, the potential public interest benefits (e.g., disaster recovery), and how ATC has been implemented from a regulatory and coordination perspective in other countries and regions. In addition, these fora could be a place for regulators to describe recommended procedures or best practices on how to coordinate ATC/CGC networks as part of MSS coordination procedures. We note that such an information paper was prepared prior to the last WRC, but much has happened since then and an update would be appropriate.

Conclusion

Inmarsat respectfully requests that the IWG-4 consider these factors in evaluating the necessity of proceeding with LightSquared's risky, complex and unnecessary approach to international deployment of ATC/CGC through modification of the ITU Radio Regulations.

Inmarsat also requests that this document be forwarded to the WRC Advisory Committee (WAC) if the IWG-4 decides to send LightSquared's proposals to the WAC without consensus.

DOCUMENT WAC/104(26.10.10)

UNITED STATES OF AMERICA

DRAFT PROPOSAL FOR WRC-12

AGENDA ITEM 7: to consider possible changes in response to Resolution 86 (Rev. Marrakesh, 2002) of the Plenipotentiary Conference: "Advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks", in accordance with Resolution **86 (Rev.WRC-07)**

ISSUE: Coordination Arc Applicable to FSS Geostationary Satellite Networks in Certain Congested Portions of the 4/6 GHz and 10/11/12/14 GHz Frequency Bands

BACKGROUND: In certain portions of the 6/4 GHz band[1] as well as of the 10/11/12/14 GHz band[2], a new GSO FSS satellite network is likely required to effect coordination with a large number of other satellite networks with orbital separations in the range of 2º to 4º or even with less than 2º separation. The need to co-exist and ensure appropriate protection to all these satellite networks implies that coexistence with and protection of satellite networks with larger separation angles will automatically result and coordination with such networks is actually unnecessary.

One of the consequences of this situation is that many of the coordinations triggered by the current coordination arcs of 10º (6/4 GHz) and 9º (10/11/12/14 GHz) are never conducted because neither of the parties involved feels an actual need for it to be done. The burden of having to conduct coordination with satellite networks which are closer to the incoming network is already heavy enough to discourage operators and administrations to devote scarce resources to conduct coordination exercises that are clearly unnecessary.

Satellite networks in 6/4 GHz and 10/11/12/14 GHz

To assess the number of coordinations likely to be triggered in the 6/4 GHz band, a query to the ITU BR SNS database identified the satellite networks with frequency assignments in the range 3 700-4 200 MHz[3]. Satellite networks including this frequency range are found in 498 distinct orbital locations, some of them separated by only 0.1º. In most of these orbital locations there are multiple satellite networks, often filed by different administrations.

This means that the average orbital separation between neighbouring orbital locations with filings in the 3 700-4 200 MHz band is about 0.72º[4]. Moreover, within the current coordination arc of ±10º a new satellite network will on average have to coordinate with satellite networks at about 28 other orbital locations and many of these locations will include networks from multiple administrations.

Similarly, a query of the SNS for the band 14-14.5 GHz reveals that there are 527 distinct orbital locations with satellite networks with frequency assignments within this range[5]. This means that the average orbital separation between neighbouring orbital locations with filings in the 14-14.5 GHz band is about 0.68º[6].

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1 3 400-4 200 MHz (space-to-Earth), 5 725-5 850 MHz (Earth-to-space) in Region 1, 5 850-6 725 MHz (Earth-to-space), 7 025-7 075 MHz (space-to-Earth) and (Earth-to-space).

2 10.95-11.2 GHz (space-to-Earth), 11.45-11.7 GHz (space-to-Earth), 11.7-12.2 GHz (space-to-Earth) in Region 2, 12.2-12.5 GHz (space-to-Earth) in Region 3, 12.5-12.75 GHz (space-to-Earth) in Regions 1 and 3, 12.7-12.75 GHz (Earth-to-space) in Region 2, and 13.75-14.5 GHz (Earth-to-space)

3 Query was conducted in early February 2010. The query included satellite networks with submitted advance publication information, with or without a coordination request or notification information submission.

4 Note that the average orbital separation between any two satellite networks is smaller than that because the separation of 0º between collocated satellite networks was not included in the computation of this average value.

5 See 3 above.

Therefore, within the current coordination arc of ±9º a new satellite network will on average have to coordinate with satellite networks at about 26 other orbital locations and many of these locations will include networks from multiple administrations.

In view of the assessment described above, it is concluded that the coordination arc of ±10º for satellite networks using the 6/4 GHz band is excessive. To assist in the evaluation of possible reduced values for the coordination arc, it is useful to assess the number of networks a satellite network would have to coordinate with, on average, if the coordination arc is reduced to alternative values. If the coordination arc is reduced to ±5º any new satellite network will on average still have to coordinate with satellite networks at 14 other orbital locations and coordination with satellite networks outside the 5º arc becomes unnecessary. Similarly, if the coordination arc is reduced to ±6º any new satellite network will on average still have to coordinate with satellite networks at 17 other orbital locations. Any constraints that may have to be imposed on the new comer in order to protect networks outside of these reduced arcs will already have been imposed by the significant number of networks within the arc.

Similarly, it is concluded from the above that the coordination arc of ±9º for satellite networks using the 10/11/12/14 GHz band is also excessive. Again, to assist in the evaluation of possible reduced values for the coordination arc, it is useful to assess the number of networks a satellite network would have to coordinate with, on average, if the coordination arc is reduced to alternative values. If the coordination arc is reduced to ±4º any new satellite network will on average still have to coordinate with satellite networks at 12 other orbital locations and coordination with satellite networks outside the 4º arc becomes unnecessary. Similarly, if the coordination arc is reduced to ±5º any new satellite network will on average still have to coordinate with satellite networks at 15 other orbital locations. Again, protection of the satellite networks within these reduced arcs of the new satellite network ensure that satellite networks outside the arc will also be protected.

Although the reasoning above was based on average values, a closer look at the distribution of satellite networks along the geostationary orbit reveals that the values of the orbital interval between adjacent satellite networks are limited to a small range. Actually, both for 6/4 GHz and 10/11/12/14 GHz, more than 90% of these orbital intervals do not exceed 1º. This means that adoption of the ±5º arc for satellite networks using the 6/4 GHz or of the ±4º arc for satellite networks using the 10/11/12/14 GHz band will still require that any new satellite network coordinate with several other satellite networks.

For satellite networks using the band 3 700-4 200 MHz the distribution of orbital spacing between adjacent orbital locations is shown in Table 1. It is concluded from Table 1 that almost 59% of these orbital intervals are 0.5º or less and more than 90% of the intervals are 1º or less.

The maximum orbital spacing is 4º which occurs only once, between 150ºW and 154ºW. Even in this extreme situation, a hypothetical satellite network at 152ºW would have to coordinate with satellite networks from five different administrations with satellite networks at 147.6ºW, 148ºW, 150ºW, 154ºW, 155ºW and 156ºW. Coordination constraints imposed on the new satellite network by satellite networks at these six orbital locations would provide adequate protection to satellite networks outside the smallest of the coordination arcs considered above, ±5º.

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6 See 4 above.

TABLE 1

Distribution of the orbital separation (δ) between adjacent orbital locations with satellite networks[7] including the frequency range 3 700-4 200 MHz

Orbital Separation (δ)	Number of Occurrences	Percentage (%)
0< δ<0.5	124	24.91
0.5	169	33.94
0.5< δ<1.0	36	7.23
1.0	121	24.30
1.0< δ<1.5	6	1.20
1.5	6	1.20
1.5< δ<2.0	3	0.60
2.0	27	5.42
2.5	4	0.80
3.0	1	0.20
4.0	1	0.20
Total Number of Intervals	498	100

For satellite networks using the band 14-14.5 GHz the distribution of orbital spacing between adjacent orbital locations is shown in Table 2. It is concluded from Table 2 that about 59% of these orbital intervals are 0.5º or less and more than 92% of the intervals are 1º or less.

The maximum orbital spacing is 3º which occurs only once, between 140ºW and 143ºW. Even in this extreme situation, a hypothetical satellite network at 141.5ºW would have to coordinate with satellite networks from six different administrations with satellite networks at 138ºW, 139ºW, 140ºW, 143ºW and 144ºW. Coordination constraints imposed on the new satellite network by satellite networks at these five orbital locations would provide adequate protection to satellite networks outside the smallest of the coordination arcs considered above, ±4º.

The distributions in Tables 1 and 2 are quite similar as many satellite networks include both the 6/4 GHz and the 10/11/12/14 GHz frequency ranges. For both distributions the mode is the interval of 0.5º while intervals of 1º and the aggregate of those of less than 0.5º have about the same frequency of occurrence.

TABLE 2

Distribution of the orbital separation (δ) between adjacent orbital locations with satellite networks[8] including the frequency range 14-14.5 GHz

Orbital separation (δ)	Number of occurrences	Percentage (%)
0< δ<0.5	136	25.81
0.5	177	33.59
0.5< δ<1.0	44	8.35
1.0	131	24.86
1.0< δ<1.5	5	0.95
1.5	5	0.95
1.5< δ<2.0	2	0.34
2.0	25	4.74

7 Satellite networks referenced here include those with submitted advance publication information, with or without a coordination request or notification information submission.

8 Satellite networks referenced here include advance publication information and coordination requests.

2.5	1	0.19
3.0	1	0.19
Total Number of Intervals	527	100

Satellites Currently in Orbit Using Frequencies in 6/4 GHz and 10/11/12/14 GHz

In order to further corroborate the above assessment that is based on satellite networks filed with the ITU, a similar assessment based on satellites currently in orbit was conducted. This assessment concluded that that the number of geostationary satellites currently in orbit which utilize the frequencies 3 700-4 200 MHz is 168. Table 3 shows the distribution of the orbital separation between satellites currently in orbit using the band 3 700-4 200 MHz.

It can be concluded that the average orbital separation between two satellites currently in orbit using the frequencies 3 700-4 200 MHz is about 2.16°. Based on the number of filed satellite networks, as discussed above, it was concluded that, for a 5° coordination arc, on the average a newly filed network would have to coordinate with satellite networks in 14 other orbital locations. It is now concluded that the average number of satellites currently in orbit involved in these coordinations would be approximately 4.6. For a possible coordination arc of 6°, the average number of satellites involved in the coordination increases to 6.

It has been noted that the distribution of satellites currently in orbit is significantly non-uniform over the 360° geostationary arc. In the arc 139 °W to 180 °E the average orbital separation becomes about 1.92°[9] while there are only two satellites in the interval (139 °W-180 °W). The largest arc without a satellite using the frequencies 3 700-4 200 MHz extends from 139 °W to 167 °W. Therefore, for a 5° coordination arc a hypothetical filing at, for instance, 153 °W would have to coordinate with several satellite networks but at the moment none of these networks would be associated with a satellite already in orbit. Although reducing the coordination arc from 10° to 5° would lead to more occurrences of such a situation, it is also true that not having to coordinate with a network associated with a satellite in orbit would currently occur for any filing between 149 °W and 157 °W[10].

TABLE 3

Distribution of the orbital separation (δ) between adjacent satellites that include the frequency range 3 700-4 200 MHz (coverage overlapping was not taken into account; frequency overlapping may be total or partial)

Orbital separation (δ°)	Number of occurrences	Percentage (%)
$0 \leq \delta \leq 0.5$	32	19.16
$0.5 < \delta \leq 1.0$	19	11.38
$1.0 < \delta \leq 1.5$	15	8.98
$1.5 < \delta \leq 2.0$	43	25.75
$2.0 < \delta \leq 3.0$	35	20.96
$3.0 < \delta \leq 4.0$	13	7.78
$4.0 < \delta \leq 5.0$	3	1.80
$\Delta > 5.0$	7	4.19
Total number of intervals	167	100

[9] In the arc 139° W to 180° E a new filing would have to coordinate with networks that on average would be associated with approximately 5.2 satellites currently in orbit involved.

[10] These assertions are being made discarding the possibility that a satellite network outside the coordination arc could request to be included in the coordination based on the $\Delta T/T$ criterion.

Similarly, an assessment of geostationary satellites currently in orbit which utilize the frequencies 14.0-14.5 GHz led to a total of 194 satellites. Table 4 shows the distribution of the orbital separation between satellites currently in orbit using the band 14.0-14.5 GHz.

It can be concluded that the average orbital separation between two satellites currently in orbit using the frequencies 14.0-14.5 GHz is about 1.87°. Based on the number of filed satellite networks, as discussed above, it was concluded that, for a 4° coordination arc, on the average a newly filed network would have to coordinate with satellite networks in 12 other orbital locations. It is now concluded that the average number of satellites currently in orbit involved in these coordinations would be approximately 4.3. For a possible coordination arc of 5°, the average number of satellites involved in the coordination increases to 5.3.

It has been noted that the distribution of satellites currently in orbit is significantly non-uniform over the 360° geostationary arc. In the arc 129 °W to 180 °E the average orbital separation becomes about 1.62° while there are only two satellites in the interval (139 °W-180 °W). The largest arc without a satellite using the frequencies 14.0-14.5 GHz extends from 129 °W to 167 °W. Therefore, for a 4° coordination arc a hypothetical filing at, for instance, 148° W would have to coordinate with several satellite networks but at the moment none of these networks would be associated with a satellite already in orbit. Although reducing the coordination arc from 9° to 4° would lead to more occurrences of such a situation, it is also true that not having to coordinate with a network associated with a satellite in orbit would currently occur for any filing between 138 °W and 158 °W[11].

TABLE 4

Distribution of the orbital separation (δ) between adjacent satellites that include the frequency range 14.0-14.5 GHz (coverage overlapping was not taken into account; frequency overlapping may be total or partial)

Orbital separation (δ°)	Number of occurrences	Percentage (%)
$0 \leq \delta \leq 0.5$	52	26.94
$0.5 < \delta \leq 1.0$	16	8.29
$1.0 < \delta \leq 1.5$	19	9.84
$1.5 < \delta \leq 2.0$	49	25.39
$2.0 < \delta \leq 3.0$	39	20.20
$3.0 < \delta \leq 4.0$	14	7.25
$4.0 < \delta \leq 5.0$	1	0.52
$\delta > 5.0$	3	1.55
Total number of intervals	193	100

Finally, it is noted that a reduction in the size of the coordination arc will eliminate coordination requirements that are often either not fulfilled[12] or carried out as a mere formality. Even with reduced coordination arcs, satellite networks in 6/4 GHz or in the 10/11/12/14 GHz which are outside the applicable arcs are already significantly constrained by other closer by satellite networks. Therefore, coordination between satellite networks that are far apart will either confirm the constraints imposed by closer networks or will lead to lighter constraints that are not applicable as they will be overcome by the former constraints.

[11] These assertions are being made discarding the possibility that a satellite network outside the coordination arc request to be included in the coordination based on the ΔT/T criterion.

[12] Recording is possible through the application of RR No.**11.32A** or No.**11.41**.

Taking into account the above analyses, it is proposed that a slightly more conservative approach be taken. Accordingly, it is proposed here that coordination arcs of 6º for satellite networks in 6/4 GHz and 5º for satellite net 10/11/12/14 GHz be adopted.

PROPOSAL:

MOD USA/7/1

Annex 1
TABLE 5-1 (WRC-07)
Technical conditions for coordination
(see Article **9**)

Reference of Article 9	**Case**	**Frequency bands (and Region) of the service for which coordination is sought**	**Threshold/condition**	**Calculation method**	**Remarks**
No. **9.7** GSO/GSO	A station in a satellite network using the geostationary-satellite orbit (GSO), in any space radiocommunication service, in a frequency band and in a Region where this service is not subject to a Plan, in respect of any other satellite network using that orbit, in any space radio-communication service in a frequency band and in a Region where this service is not subject to a Plan, with the exception of the coordination between earth stations operating in the opposite direction of transmission	1) 3 400-4 200 MHz 5 725-5 850 MHz (Region 1) and 5 850-6 725 MHz 7 025-7 075 MHz	i) Bandwidth overlap, and ii) any network in the fixed-satellite service (FSS) and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±~~10~~6° of the nominal orbital position of a proposed network in the FSS		With respect to the space services listed in the threshold/condition column in the bands in 1), 2), 3), 4), 5), 6), 7) and 8), an administration may request, pursuant to No. **9.41**, to be included in requests for coordination, indicating the networks for which the value of $\Delta T/T$ calculated by the method in § 2.2.1.2 and 3.2 of Appendix **8** exceeds 6%. When the Bureau, on request by an affected administration, studies this information pursuant to No. **9.42**, the calculation method given in § 2.2.1.2 and 3.2 of Appendix **8** shall be used
		2) 10.95-11.2 GHz 11.45-11.7 GHz 11.7-12.2 GHz (Region 2) 12.2-12.5 GHz (Region 3) 12.5-12.75 GHz (Regions 1 and 3) 12.7-12.75 GHz (Region 2) and 13.75-14.5 GHz	i) Bandwidth overlap, and ii) any network in the FSS or broadcasting-satellite service (BSS), not subject to a Plan, and any associated space operation functions (see No. **1.23**) with a space station within an orbital arc of ±~~9~~5° of the nominal orbital position of a proposed network in the FSS or BSS, not subject to a Plan		

Reasons: In view of the discussion in the Background Section, the United States proposes that the coordination arc applicable to FSS geostationary satellite networks in certain congested portions of the 4/6 GHz and 10/11/12/14 GHz frequency bands be reduced from 10º to 6º in 4/6 GHz and from 9º to 5º in 10/11/12/14 GHz.

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DOCUMENT WAC/105(26.10.10)

UNITED STATES OF AMERICA
DRAFT PROPOSALS FOR THE WORK OF THE CONFERENCE

Agenda Item 1.2: t*aking into account the ITU-R studies carried out in accordance with Resolution **951 (Rev. WRC-07)**, to take appropriate action with a view to enhancing the international regulatory framework*

Background Information: The subject matter considered under Agenda item 1.2 was first addressed at WRC-07 as agenda item 7.1, at the request of WRC-03. The agenda item asked WRC-07 to review the international spectrum regulatory framework in accordance with Resolution **951 (WRC-03)**, "Options to improve the international spectrum regulatory framework." The Director's Report to WRC-07 included the results of the ITU-R studies in response to Resolution **951 (WRC-03)**. WRC-07 concluded that further study on this topic was necessary and Agenda Item 1.2 for WRC-12 was adopted.

Under this Agenda Item extensive studies were undertaken, however to date there has been no consensus regarding the regulatory options investigated. To a large extent the attempt to develop broad regulatory changes that would apply across a significant portion of the Radio Regulations has been difficult. The impact of the proposed broad changes can not readily be quantified and therefore impact on other radiocommunication services is difficult to determine. For example, changes to the basic definitions or type of parameters that can be notified for the fixed service could have serious ramifications for sharing with other co-frequency radiocommunication services. This is particularly true for the fixed-satellite service as a number of frequency bands are shared between the fixed and fixed-satellite services.

One of the Options studied is to keep the current practice, where the mechanism to enhance the Radio Regulations would be undertaken under specific agenda items adopted at the previous WRC based on proposals made by Administrations. This mechanism is well known, established and has generally resulted in satisfying requirements of Administrations. Another Option considered was to modify or propose new definitions in Article 1 of the Radio Regulations.

In order to take advantage of the results of the studies undertaken in the ITU-R under Agenda Item 1.2, the U.S. proposes a modification of Recommendation 34. The modifications to the Recommendation provide guidance to ITU-R participants when undertaking studies under WRC agenda items or under their on-going studies when developing ITU-R Recommendations or Reports. The modification to Recommendation 34 supports allocations with appropriate footnote and regulatory provisions in order to accommodate convergence in the services and applications that might be provided within an allocation to the extent practicable and provide Administrations flexibility in the types of radiocommunication services and applications deployed in their countries and globally through harmonizing spectrum to the extent practicable. The revision also recognizes that provisional and interim procedures have been adopted by previous WRCs in order to implement emerging technologies in a timely fashion. The Resolution also provides a long term framework for the establishment of future allocations with associated footnotes and regulatory provisions to address multiple radio services and applications that might be permitted with an allocation.

Proposal:
NOC USA/AI1.2/1

ARTICLE 1
Terms and definitions

Reasons: The United States supports NOC to the existing definitions in Article 1. Any changes to the existing definitions would have far-reaching impact, as they would immediately modify all of the related allocations in the Table of Frequency Allocations. The United States is open, however, to considering new definitions as might be required to address new applications.

MOD USA/AI1.2/2

RESOLUTION ~~COMMENDATION 34~~ XX (WRC-12~~95~~)

Principles for the ~~allocation~~ management and use of frequency bands

The World Radiocommunication Conference (Geneva, 2012~~1995~~),

considering

a) that ITU should maintain an international Table of Frequency Allocations covering the usable radio-frequency spectrum;

b) that one of the primary objectives of the Radio Regulations is to provide for and, where necessary, regulate new applications of radiocommunication technology, (see No. **0.10**);

~~*b)*~~*c)* that it may be desirable, in certain cases, to allocate frequency bands to multiple radio services and/or to adopt appropriate footnotes and regulatory provisions ~~to the most broadly defined services~~ in order to improve flexibility of use of frequencies to permit new radio applications within existing allocations but without detriment to other radio services;

~~*c)*~~*d)* that the development of common worldwide allocations is desirable in order to improve and harmonize utilization of the radio-frequency spectrum;

~~*d)*~~*e)* that adherence to these principles for the allocation and use of spectrum will allow the Table of Frequency Allocations to focus on matters of regulatory significance while enabling greater flexibility in national and international spectrum use~~;~~,

f) that many radiocommunication stations and systems today are capable of and provide more than one radiocommunication service and that this convergence of radiocommunication services and applications operating from a single station on the same frequency or different frequencies is expected to grow;

g) that WRC-03 adopted footnotes and regulatory provisions to provide administrations with the flexibility to operate earth stations on board vessels (ESVs) with space stations in the existing fixed-satellite service allocations,

considering further

a) that wireless applications often are the most cost-effective and practicable means of delivering advanced information and communication technologies (ICTs) in many countries;

b) that bridging the digital divide and bringing the benefits of ICTs to all citizens is fundamental for providing opportunities, for example for education, business development and active participation in the information society;

c) that deployment of wireless broadband applications can facilitate connectivity to schools, rural communities and healthcare facilities, that is vital to economic development and to making effective use of ICTs;

d) that there is a need to continually take advantage of technological developments in order to increase the efficient use of spectrum and spectrum access;

e) that satellite systems and networks can provide wireless broadband applications including meeting the particular needs of developing countries and rural areas;

f) that satellite-based wireless broadband systems can provide service over a wide geographic area and are particularly suited for emergency and disaster recovery communications and rural communications;

g) that the convergence of multiple radiocommunication services and applications operating from a single station may warrant the consideration of new service definitions if the existing service definitions do not adequately support this convergence,

recognizing

that previous Conferences have adopted regulatory provisions, including on an interim or provisional basis, to allow implementation of emerging technologies in an expeditious manner taking into account existing users,

resolves ~~recommends t~~hat future world radiocommunication conferences

1 that allocation of frequency bands and associated footnotes and regulatory provisions should, wherever possible, ~~allocate frequency bands to the most broadly defined services with a view to~~ provide~~ing~~ the maximum flexibility to administrations in accommodating emerging radio applications including new technologies~~spectrum use~~, taking into account safety, technical, operational, economic and other relevant factors;

2 that frequency bands should, wherever possible, be allocated ~~frequency bands~~ on a worldwide basis (aligned radio services, categories of radio service and frequency band limits) taking into account safety, technical, operational, economic and other relevant factors and using appropriate footnotes and regulatory provisions as needed to clarify these factors and to provide for additional radio applications permitted within the context of a specific allocation,~~;~~

~~3 should take into account relevant studies by the Radiocommunication Sector and the reports of the relevant Conference Preparatory Meetings (CPM),~~

~~*recommends*~~ *invites administrations*

to take account of *resolves 1* and *2* and *considering further a)* to *f)*, when~~in~~ making proposals to world radiocommunication conferences, ~~to take account of *recommends* 1 to 3,~~

~~*instructs the Director of the Radiocommunication Bureau and*~~ *requests the ITU-R study groups*

1 when carrying out technical studies relating to a frequency band pursuant to specific WRC agenda items, to examine the compatibility of new applications ~~of a broad definition~~ of radio services with the existing utilizations and the possibility of aligning allocations on a worldwide basis, having regard to *considerings a)*~~, *b)*, *c)*,~~ and ~~*d)*~~ to *f), considering further a)* to ~~g~~*f)* and *resolves* ~~*commends*~~ 1~~,~~ and 2 ~~and 3~~ above;

2 when carrying out the technical studies referred to in *request the ITU-R study groups 1)*, to also examine the regulatory provisions in the Radio Regulations with respect to the appropriate coordination and notification procedures when multiple radiocommunication services and applications are being provided by one station in the same frequency band;

~~2~~3 to conduct these studies, where appropriate in cooperation with the International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO);

~~3to submit a report to future world radiocommunication conferences containing the results of these studies,~~

~~*invites*~~

~~the relevant CPM and Radiocommunication Study Groups to identify areas for study and to undertake the studies necessary to determine the impact on existing services of those agenda items of future world radiocommunication conferences which involve broadening the scope of existing service allocations,~~

instructs the Secretary-General

to communicate this Resolution ~~commendation~~ to ICAO and IMO.